

Contractors and Engineers Monthly



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PICKS and SHOVELS

BY O. E. POTTER

News Events of Long Ago

The "Horseless Carriage News" published in *Highway Highlights* called to our attention two news items of the early 1900's which in this day seem oddly quaint. The first appearing in Milwaukee in 1903 announces that the City Council has decided not to prosecute any more cases of automobile owners who operate machines without gongs, adding that there would be no further arrests until the council had acted upon a petition to permit the use of horns instead.

The second item appearing in a Washington paper in 1904 states that General Miles says that motor bicycles will take the place of horses in the next war, and the money wasted on a mounted force should be spent on a road building corps.

Which latter still makes good sense.

Filing Teeth of Termites To Render Them Harmless

This problem of termites which keeps popping up into discussions and the news is by no means a modern one. Even termite rackets existed in the past, according to Dr. Thomas E. Snyder, Senior Entomologist, U. S. Department of Agriculture and a leading authority on termites and their control. In his book on the subject, Dr. Snyder says that as early as 1876, Hagen tells an amusing incident of how the known capacity for destructiveness of termites was used by rogues to cover thievery. A large amount of property stored by the French Government in Ile de France (Mauritius) was reported to have been destroyed by termites. The home ministers sent to the colonial officers a box containing files, with strict orders to capture each termite, place it in a vise, and file off their teeth,—or resign the post.

Sounds like interesting and novel work, if you can get it.

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Manhattan Sewer Tunnel

Unusual Rock Structure Checked By New Borings

(Photos on page 48)



Rock Asphalt Resurfacing

Early Freezing Last Fall Spoiled Late Contract So Olof Nelson, Logan, Utah, Did Smooth Summer Job

(Photos on page 48)

THE State Road Commission of Utah undertook the placing of rock asphalt on a resurfacing job rather late in the fall of 1935 which was let to Olof Nelson of Logan, Utah, and which is located just north of that city on U. S. No. 91. Freezing weather and snow came before the contractor could rush the job through with a very large crew of men. Due to the unfavorable weather, excessive ravelling of the finished surface resulted and the job had to be done over again last summer with results that are truly to be praised. With only a drag for placing the granulated rock asphalt on the old rough surface and without rolling, the work, under the direction of Vern Gillman as Superintendent, has been handled so well that the highway rides smoothly at all speeds. How was it done?

The 20-foot road of concrete was in none too good condition before the fiasco of the rock asphalt last fall. Then there were places where the new surfacing material rolled up into ridges 1 and 1½ inches high, producing really rough riding. None of these were removed but the new material was carefully dragged over the surface repeatedly until the holes were all filled and the surface rode smoothly.

The granulated rock asphalt was produced at Sunnyside, Utah, in Carbon County in the southeastern corner of the state and delivered to Smithfield near the northern end of the project. The specifications require that it be sprayed with about 5 per cent of water, crushed and loaded at night when the material is to be used in summer so that it will not consolidate in shipment.

(Continued on page 26)

Change of Plans Keeps Tunnel in Solid Rock; George H. Flinn Corp. Holes Through on Time

was made, resulting in a drastic change in the tunnel plans. Boring No. 1 was driven as a 1½-inch hole horizontally from the Manhattan face along the line of the tunnel for a distance of 47 feet and then cased down to ½-inch. The hole was driven a total of 145 feet 7½ inches and indicated the impossibility of continuing to drive the tunnel at this elevation as chlorite, a flaky rock fluid in water, ran back into the tunnel, followed by salt water at a rate of 450 gallons per minute.

Believing that the rock structure at Elev. —500 would be satisfactory, the series of borings was continued to explore the geological formations at that depth. No. 2 boring, from the Manhattan Tunnel just back of the face where work stopped at Elev. —300, was a 445-foot core driven sloping downward. This core went through the chlorite into limestone and then to the contact plane between the limestone and a second pocket of the chlorite. This contact plane gave the slope of the limestone formation so that it could be plotted on the profile shown on page 48. The chlorite ran back into this hole, a distance of 250 feet, in 4 hours.

No. 3, bored from the Manhattan Tunnel on a slope slightly steeper than No. 2, was driven a distance of 233 feet to locate the bottom of the chlorite pocket.

Borings Nos. 4 and 5 were driven from the surface of the ground at Wards Island on a slope toward the East River

(Continued on page 30)

A ROAD SCENE ALONG THE MISSISSIPPI



C. & E. M. Photo
Activity Around the Paver on the Mages 10-Mile Concrete Paving Job North of Wabasha, Minn. See Page 23.

Old Nevada Geiger Grade Yields to High-Gear Road

\$700,000,000 in Gold and Silver Bullion, Dug from Comstock Lode, Was Hauled Out Over Famous Old Grade

(Photo on page 48)

VIRGINIA City, Nevada, settled in 1859, and a thriving metropolis of 30,000 hardy souls in 1874 when the great Comstock Lode was at its zenith, had become a ghost town by the turn of the century, but increasing activity in the mines that have brought forth \$300,000,000 in gold and \$400,000,000 in silver in the last 77 years now stimulates the 1,500 population to greater hopes for the future. There's lots more precious metal in those hills. The old Geiger Grade, named for that pioneer road-builder of the west, Charles Geiger, saw locomotives and other machinery for the mines hauled piece by piece over its twisted back; saw all the food, clothing, and the liquor for the famous Crystal Bar in Virginia City hauled in, and the precious bullion hauled out.

The new grade, slightly longer than the old, is far safer and has no "Dead Man's Curve" for automobiles to crash over, as stage coaches, pack trains and even pony express riders did on the old road. The new surfaced road is wider, and the maximum grade is 6 per cent while a 14 per cent grade hampered the drivers on the old road. Enough of history. If one is really interested in the story of the old mining days in Nevada, the July, 1936, issue of that well-illustrated and interestingly written magazine *Nevada Highways and Parks*, issued by the Nevada State Highway Department, will tell you the whole story with many photographs of the old days. We wish to tell you here how the Nevada engineers built 7.45 miles of new road and used 205,000 man-hours of labor effectively.

Two Contracts

The contract for the northern section toward Reno was started on November 12, 1935, and completed about the middle of May, 1936, at a cost of \$116,700.80. The work started with 50 employees and increased steadily to use the

91,521 man-hours required. The south unit, about 3 miles in length, was started in November, 1935, and was officially completed May 8, 1936, at a cost of \$141,419.47, using all the 113,848 man-hours required. The employment on the two sections was maintained at between 300 and 400 most of the time, with a maximum of 500, all from the relief rolls of Reno. These contracts were for the grading and drainage structures and a later contract covered the surfacing of the entire new highway with gravel and oiling. Labor was hauled out to the work each day in large motor vans equipped with seats for the men, and definite stops were made in Reno each trip to pick up the men or return them to the registration office.

Features of New Road

All curves on the new road were widened and super-elevated to permit 40-mile-per-hour speeds. The surface was graveled and oiled to a width of 26 feet uniformly over the entire length on tangents. The shoulders vary from 5 to 10 feet in width, the wider shoulders being where there was more material to waste and it was carried uniformly along the shoulders to increase the safety of the



C. & E. M. Photo

Before the Slope of This Sidehill Cut Was Rounded, All Loose Rock Landed in the Middle of the Road. Now It Hugs the Face of the Cut.

highway. On the fills, all large rocks were covered insofar as possible and all the fills were carefully outlined with hand-placed rock at the toes. The fills were trimmed on a 1 1/2 to 1 slope. The Calco asphalt-coated corrugated culvert pipe was carried down the slope and covered so as to present a neat appearance.

All cuts were rounded at the top by hand and all slide and loose material for as high as 200 to 300 feet above the roadway was removed. For as much of the grade as possible the cuts were all daylighted for safety as, even with the new and better alignment, the highway

(Continued on page 16)

Maintenance Costs And Equipment

Montana Reports Expenses, Road Mileage Maintained And Equipment Types

By SCOTT P. HART, Maintenance Engineer, Montana State Highway Commission

(Photos on page 48)

THE approved maintenance budget of the Montana State Highway Commission for the 1937 fiscal year authorized the expenditure of \$1,920,000. Of this, \$1,147,500 was available for general maintenance; \$583,000 was allocated for special maintenance and betterment items, including oiling operations by state forces; \$39,500 for much needed housing facilities; and \$150,000 was ear-marked for the purchase of new equipment.

The road mileage maintained by the Montana Department of Maintenance includes 4,087 miles of bituminous surface; 37 miles of concrete pavement; 297 miles surfaced with crushed gravel; and 241 miles of graded but unsurfaced roadway, making a total of 4,662 miles. Practically all of the main traveled roads which are used by tourists and other visitors to Montana are bituminous surfaced, and the comparative

(Continued on page 24)

Keeping Snow Drifts Off State Highways

Snow Fence, Artificial Or Natural, Essential in Work of Maintenance Depts. in Snow Belt

DOES the use of snow fence pay? Among the states in the snow belt, where snow control and removal is a serious problem, the answer is overwhelmingly "Yes". C. W. Siniff, Engineer of Maintenance in Indiana, says that snow drifts can be controlled 100 per cent by the use of snow fence if a sufficient number of feet is available and it is properly installed. Utah reports a saving of as much as 20 per cent of its snow removal cost through the proper installation of snow fence in the area of heavy drifting. J. J. Forrer, Maintenance Engineer for the Virginia Department of Highways, says that the results of snow fence in very windy areas in one year clearly show snow fence to be well worth the original cost. Roads are kept open to traffic, a very important item, and snow removal is materially reduced.

E. E. Blomgren, Maintenance Engineer, Michigan State Highway Department, reports that the Department could not give the traveling public the service it now does if snow fences were not used in sections where snow drifts badly, as the use of snow fence not only reduces the chances of the road being blocked completely but also reduces the cost of keeping the road open to traffic. Practically the same experience is reported by W. H. Root, Maintenance Engineer for the Iowa Highway Commission, who adds that the drought conditions of recent years, which has resulted in nearly all the corn being cut instead of the stalks being left standing in the fields, has greatly increased their need of snow fence.

From the great open spaces of Montana and Wyoming, where drifts

may be mountains, come the same reports. Scott P. Hart, Maintenance Engineer for the Montana State Highway Commission, writes that it has been their experience in Montana that the proper use of snow fence is absolutely essential in preventing the formation of snow drifts which otherwise would block their highways. Even if it were possible to do so, the cost of keeping Montana highways open to traffic during the winter months would be prohibitive if it were not for the protection which the snow fence affords. Wyoming has found the use of snow fence absolutely necessary, says James B. True, Road Superintendent for Wyoming, who believes that the investment in snow fence saves many times the cost in snow removal work.

From F. N. Grant, District Engineer for the Arizona Highway Department, comes the report of snow fence's effectiveness in minimizing drifts, plus the information that Arizona is planning to extend several fences next year, as well as to add about 5,000 feet on new roads. We call next on the Gentleman from New Jersey, Alex W. Muir, Superintendent of Maintenance, who says, "We are of the opinion that the use of artificial snow fence is very effective in the control of drifting. On some occasions, however, in heavy falls the 4-foot type of snow fence adopted by this Department has not been of sufficient height, the snow having drifted into the roadway as the drifts reached a height of 4 feet behind the snow fence."

The general tendency seems to be toward more and more snow fence, as money for its purchase becomes available, and many states find artificial snow fence preferable to natural snow

(Continued on page 28)

State	Fence Used	Average Feet from Roadway	Height (in feet)	Feet Purchased Annually	
				Varies	Varies
Arizona	33,000	75	4	4,000	
California	90,000	1	8	25,000	
Colorado	360,000	70	4	70,000	
Connecticut	154,755	Varies	6		
Delaware	157,000	110	4		
Illinois	1,320,000	85	4		
Indiana	60,000	75	4		
Iowa	7,900,000	150	4		
Kansas	2,415,540	75	4	250,000	
Maine	1,096,705 ^a	90	4	475,200	
Maryland	800,000	50	4	80,000	
Massachusetts	285,120	60-75	4		
Michigan	3,769,630	70	4		
Minnesota	6,132,327	125	4	400,000	
Missouri	1,317,000	280-75	4	Varies	
Montana	1,324,217	100	5	158,000 ^b	
Nebraska	3,864,000	75	5	225,000	
Nevada	100,370	280-75	4	26,400	
New Hampshire	766,250	75	4	75,000	
New Jersey	480,300	45	4	Varies	
New Mexico	14,800	75	5		
North Dakota	3,000,000	200	4	25,000	
Ohio	667,600	75	4	100,000	
Oklahoma	144,870	150	4	25,200	
Oregon	45,000	85	6		
Pennsylvania	10,000,000	60	4	1,050,000	
Rhode Island	80,700	100-80	4		
South Dakota	1,491,909	125	4	100,000	
Utah	644,160	75-85	2.5	55,000	
Vermont	534,314	75-100	4		
Virginia	40,000	100	4		
Washington	167,450	175	4	5,270	
West Virginia	219,050	77.5	4	16,600	
Wisconsin	6,864,000	300-90	4	Varies	
Wyoming	650,000	115	5	10,000	

^aSet on approximately 6:1 slope on windward side of road.

^bMade up by department. Very little purchased.

^cNot purchased annually.
^dIn addition, there is 1,825,735 feet of snow fence erected by municipalities on state-aid highways and townways, for which the State Highway Department shares the cost.

^eDependent on available funds.

^f764,744 feet purchased in 1936.

^gSnow fence for new roads erected as contract item incidental to construction.

^hVery little snow fence is required in New Mexico. Where it is needed, it has been erected as a permanent installation.

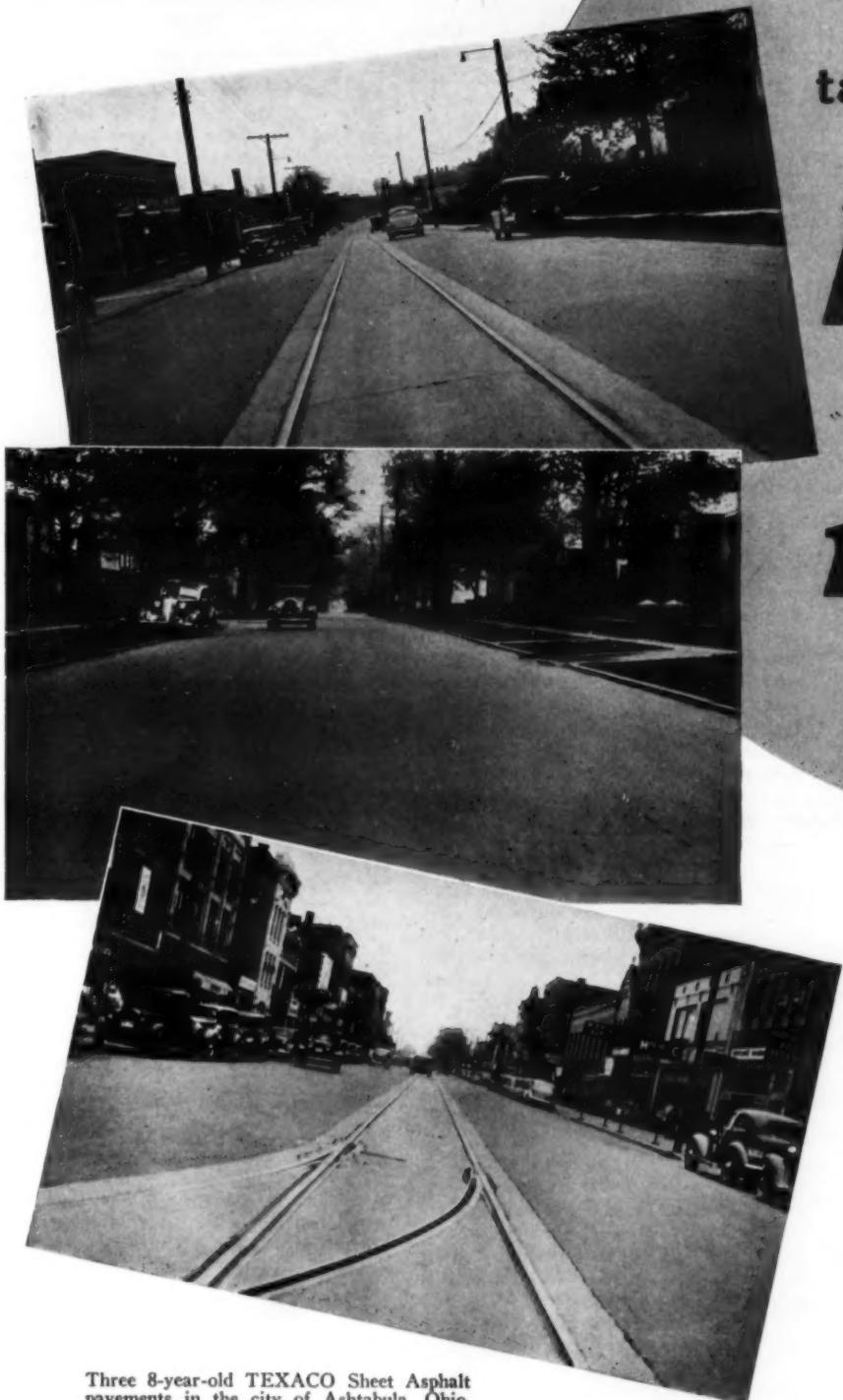
ⁱPractically all new fence installed is of the permanent type.



C. & E. M. Photo

Hand-Placed Rock Outlining Toe of Fill on the New Geiger Grade as Seen from Top of Dead Man's Curve on the Old Grade.

The wise contractor
takes no chances with his
*hard-won
reputation*



Three 8-year-old TEXACO Sheet Asphalt pavements in the city of Ashtabula, Ohio, laid by Koski Construction Company

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Plan Your Snow Fighting Now!

Present day motor vehicles and other of our modern labor-saving inventions have created unusual conditions of isolation when snow blocks our highways. We think of every inhabitant in the smallest village being in the closest touch with the world through his radio but the vast delivery systems for food supplies have robbed thousands of isolated communities of the independence they knew in years past when every pantry housed its barrel of flour, homemade preserves or dried fruits, eggs put down in water glass and stores of other staple products.

Old Dobbin flounders through the snow far more readily than the modern motor vehicle and the light sleigh he pulled could navigate almost any snowfall. How different now when sudden snow and icy blasts pile drifts in cuts and completely cripple all highway transportation! The only defenders of our traffic arteries, over which foodstuffs are hauled and the vital services of the physician are available, are the state and county snow fighting forces. Snow fence plays its part but in the heaviest snowfalls even 6-foot snow fence is buried and the heavy-duty plow is the only weapon that can be used.

Don't be complacent just because you didn't see much snow last winter, northwest states and counties excepted, because no one, not even the 80 per cent-

correct weather man, can predict whether there will be much or little snow next winter. Long or short fur on beavers, large or small stores of nuts accumulated by squirrels, mean nothing to you when you are faced with a single huge snowstorm that completely blocks roads and cripples transportation.

There was a series of winters, prior to 1936, when the snowfall was pitifully small, and many states, counties and even cities figured that they might as well economize on snow removal equipment. Then came the flood—of snow—in the winter of 1935-36, catching hundreds of organizations unprepared. Special delivery letters, telegrams and long distance telephone calls failed to produce the plows in time for the second or even the third heavy snowstorm of the winter. Manufacturers cannot carry stocks of plows sufficient to care for the needs of all prospective customers and neither can they manufacture the heavy, sturdy plowing units overnight.

Take account of stock while you can still do it with your straw hat on and without a sheepskin windbreaker. Overhaul every piece of equipment to determine just what replacements are necessary, from bolts to blades, and place your orders for parts and new plows immediately. This will place you in a position to use your light and heavy plows effectively when the first snowstorm hits.

The Editor Afield

Starting out from New Orleans last month we have threaded our way through the States of Louisiana, Mississippi and Arkansas and parts of Missouri, Alabama, Tennessee, Illinois and Indiana, studying major construction operations to report to you in detail later this year.

Perhaps the most interesting and remarkable project included was a tour of the Atchafalaya Floodway from Morgan City, La., north to Krotz Springs by air, boat and motor. This area is a marvel for those who have not seen it before. Hydraulic dredges are building up levees of materials which a few years ago would have been frowned upon as unsatisfactory. "Pea soup and coffee grounds" characterizes the material as one sees it belched forth from the dredge pipes but when it dries it takes on the characteristic of a stable earth which stands up against the moderate flood levels experienced in the floodway.

Arkansas has embarked on a series of experimental contracts in the use of pit-run dense-graded aggregate with the over-size screened out and with various types of cut-back asphalts varying from MC-3 to RC-3 and including RC-2C, combining some of the features of both the medium and rapid-cure cut-backs. Mixing has been done successfully with patrol blades, with multiple blades and road mixers equipped with pug mills. Arkansas is bound that she will have the right method of using her vast stores of gravel in the south as effectively as she is using the crushed rock of the

north with the open graded aggregate pavements. With the release of more of the rapidly increasing monies, impounded under the Refunding Commission agreement, for use in highway construction, she should literally unroll many miles of high-grade road mix-type asphalt pavements in the next few years and eliminate much of the great mileage of dangerous and costly gravel roads. It has been proved definitely that the loss of gravel from Arkansas graveled roads is as great as 2 inches a year. This gravel is ground up under traffic and is blown from the road by fast moving traffic, is thrown from the road by tires and some is lost into the ditches and onto the shoulders by maintenance blading too close to the shoulders from which it can not be retrieved.

Sardis Dam is going through the throes of getting under way, a miniature of the vast operations at Fort Peck. Another twelve months will see this operation in its most interesting stages with the contractor completing his work on the south-east section, while the new U.S.E.D. dredge which is being constructed on the site will be building the hydraulic dam and filling the toe drains for the north-west section. Work on the whole dam will be completed early in 1940.

Alabama is continuing her work on double bituminous surface treatment of a comparatively large mileage of roads, and levees and locks and dams continue to be built along and across the great Father of Waters.

New Possible Causes Of Concrete Scaling

To the Editor

CONTRACTORS AND ENGINEERS MONTHLY

The problem of concrete scaling, discussed in the article on page 27 of your May issue and in letters in subsequent issues, is one of paramount importance in highway engineering today.

About a decade ago the highway engineer recognized a condition in which the top sixteenth of an inch of the concrete pavement disintegrated and scaled off. This has become an increasingly serious problem until today it challenges the skill of the engineering profession. Unless it is corrected it bids well to impede the future use of concrete as a road metal.

There are many and diversified opinions offered for the causes of scaling. Those most generally advanced may be divided into three classes, (1) the use of chemicals to alleviate the ice hazard, (2) curing of the finished pavement, and (3) mechanical operations involved in the finishing of the concrete slabs. These theories will be discussed at length, and still another idea will be advanced which may possibly open another angle of attack for this condition.

Scaling From Chemical Salts

It is almost universally agreed that evidence shows that some scaling is caused by the application of sodium chloride and calcium chloride used to control the ice hazard. However, specific knowledge is lacking as to the reason why these chemical salts affect the concrete when used externally; or the relationship between scaling and concentration of solution used. There are agencies studying the action of these salts on concrete pavements, but as yet their studies are incomplete.

Until more conclusive knowledge is obtained concerning the relationship between scaling on concrete pavements with the external use of chemical salts, it is recommended that where a suitable substitute for the control of ice hazard, such as hot sand, is not feasible and where it appears that it is imperative that a chemical salt be used, a protective coating should first be applied to the concrete surface and the salts (and abrasives if used in combination) should be applied as sparingly as possible.

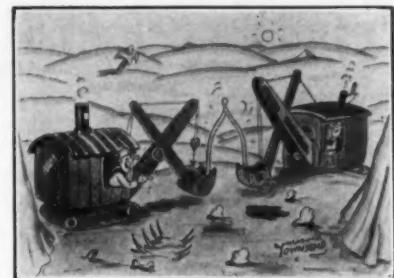
There are many suggestions for protective coatings. These include vegetable oils, refuse oils, bituminous coatings, and patented coatings containing a variety of ingredients. The relative merits of some of these coatings have been checked by experiments and actual use on the road.

The only protective coating used by the Wayne County Road Commission was an asphalt emulsion from which only indifferent results were obtained. It is questionable whether a single application of an emulsion would be of sufficient thickness to furnish an impervious coating. However, the application of an emulsion on scaled pavements has proved successful in arresting further disintegration.

A coal tar company suggests as a protective coating the use of one of its products, a hot tar of 60-150 float at 32° C., at the rate of 0.33 gallon per square yard with subsequent treatments of 0.15 gallon per square yard as needed. If the pavement is badly scaled a primer is required. It is reasonable to assume that this tar application would furnish a mat of sufficient thickness to produce an impervious coating.

Further studies on bituminous protective coating will be necessary before any definite conclusions can be drawn, but at this time it is safe to say that amounts recommended have been entirely inadequate to resist the action of chemical salts.

It must be conceded that the adherents to the opinion that scaling is caused by



the external use of chemicals have a mass of evidence to support their contention. Yet there has been scaling on pavements where no chemicals have been used. The fact that some other reasons must be advanced for this condition lends weight to the opinion that scaling is caused from inadequate curing.

Curing As Cause of Scaling

A workable mix of concrete always contains sufficient water for the complete hydration of all the chemicals in the cement used. Some of these chemicals, chiefly dicalcium silicate, must have water available for a longer period of time than is required by the other ingredients, due to their slowness of hydration. For this reason a curing agency is required to retain a portion of the water used in mixing until complete hydration of all the chemicals has taken place.

If the mixing water is allowed to evaporate or be absorbed too rapidly, there will not be a complete hydration of the cement. This results in a concrete that is substantially lower in strength and durability and excessively hair-checked, and therefore readily susceptible to scaling.

The various curing agencies are too well known to be described in detail. Whatever curing agency is used, it must have these two requisites: first, it must be effective to retain the moisture within one hour after the concrete has been finished; and second, it must retain this effectiveness for several days. Therefore, the curing agency should be employed as soon after finishing as can be done without marring the surface of the concrete.

During the limited time that the Wayne County Road Commission has used bituminized parchment paper, there has been no scaling that is directly traceable to a curing deficiency.

From the knowledge of the hydration of cement, it can be concluded that improper curing will result in a weaker concrete and one that is more susceptible to scaling. Proper curing, although extremely important, is easily obtainable and this probable cause of scale can be entirely eliminated.

Finishing As Probable Cause

Finishing of a concrete pavement is the leveling off and smoothing of the surface of the concrete to produce a smooth-riding surface. Except for irregular stretches, such as intersections, finishing is accomplished by means of a mechanical finisher equipped with a screed in front, with or without a vibrator, for leveling and compacting, and a belt of canvas or rubber in the rear for smoothing. When this operation has been completed a hand float is usually employed to work off all laitance and surplus water.

The action of the finisher and subsequent floating has a tendency to bring the fine materials in the cement and sand to the top, forming a film of mortar on the surface. The character of this film is vastly different from the mass of concrete in strength and durability. The amount and physical characteristics of the film will vary with the mix, slump, and amount of finishing. It is imperative, therefore, in designing the mix to limit the mortar to an amount which is only slightly in excess of that needed

(Continued on page 38)

New Sales Engineers for Welding Equipment in N. Y.

Francis Leslie and U. V. Westover have recently been appointed sales engineers in the New York territory for P & H Smootharc welders and weld rods, according to an announcement by the Harnischfeger Corp., of Milwaukee, manufacturer of Smootharc welding equipment.

Mr. Leslie has been in the welding

business since 1913, having been associated recently with the K-G Welding & Cutting Co. of New York City and the Superior Air Products Co. Mr. Westover graduated from the General Electric School of Welding in 1919 and spent ten years as foreman and welding supervisor in charge of training welder operators with the National Malleable Steel Casting Co. Since then he has been a welding wire sales engineer and demonstrator for Wickwire Spencer Steel Co.

Kushing Becomes Vice Pres. Of Highway Steel Products

Announcement has been made by the Highway Steel Products Co., Chicago Heights, Ill., of the appointment of J. W. Kushing, formerly Research and Testing Engineer of the Michigan State Highway Department, as Vice President in charge of engineering. Mr. Kushing will devote special attention to the highway phase of research, design and sales

of the products of this company and will enable the organization to offer broader and improved engineering service.

New Vice Pres. for Blaw-Knox

Donald C. Blakewell, who recently became affiliated with the Blaw-Knox Co., Pittsburgh, Penna., has recently been elected a Vice President of that company.

**Another
NORTHWEST
for the
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WHEN it comes to steel erection, Northwest has something for you that means extra speed. This is proved by repeat orders from some of the leading steel erectors in the country. Take the Austin Company of Chicago—two more Northwests for steel erection—that makes a total of five on this class of work over a period of thirteen years. The Northwest's ability to handle long booms—the worm boom hoist supplemented by a third drum for a live boom, a snaking line or holding line; the "feather-touch" clutch control and "variable speed motor," decelerator controlled, assure a combination that gives the utmost in accuracy under all conditions of steel erection or handling forms. Ask the Austin Company!

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GASOLINE, OIL
DIESEL OR
ELECTRIC
POWERED

Well-Planned Forms For Grade Crossings

Larson Construction Co. Builds Railroad Overpass and 3-Span Bridge at Pueblo, Colorado

PROJECT WPGH-18 and WPMH-18, a grade crossing at Salt Creek, Pueblo, Colo., included an overpass over the Santa Fe and Colorado & Southern railroads, a short embankment and a 3-span bridge over Salt Creek. Larson Construction Co., of Denver, was awarded the contract and handled the job with dispatch.

The overpass had some very interesting methods for the handling of forms and the concrete. The structure consists of two open abutments and two piers. There are four columns for each pier and the contractor laid out some very economical and useful form panels for these columns. As the columns are square, it was possible to use the same panel on all four sides and also the panel was designed to be equally strong and to fit the pier on any side without the least alteration.

The panels were composed of 1 x 6-inch planks backed by three 2 x 4-inch studs. Alternate planks of the forms projected 4 inches so that they could be nailed to the 2 x 4 of the panel at right angles to it. The 2 x 4's were placed at the extreme ends of the planks, leaving the 4-inch projection, with the third stud in the center. The planks were nailed to the studs by two 16d nails for each plank and the same for the projecting planks. These were not turned so that when it came time to pull the forms it was necessary only to back-drive the nails and remove the forms.

When the panels were placed, full height at one time, with the vertical reinforcing rods inside the form, it was customary to leave out one of the panels and the steel men used the projecting ends of the planks as ladders in climbing up to place the squares of reinforcing rods to tie the other reinforcing. When the entire reinforcing and the panels had been assembled, the columns were tied with 2 x 8 double wales on the bottom, 2 x 6 in the middle and 2 x 4 wales at the top. The tie rods were 1/2-inch diameter and held firmly with doughnut clamps.

Concreting

The contractor built a large wooden platform between the pier and abutment on each side so that the concrete could be chuted as much as possible through troughs at low angles to the piers. The concrete was mixed in a Smith 2-bag 10-S machine and wheeled with standard buggies. Marvel rubber-tired wheelbarrows were used for the sand and stone and each load was weighed on Howe wheelbarrow scales. Water was hauled from town and emptied into a G.I. cattle-watering tank from which it was pumped as it was needed for the batches.

The footings for the piers rest on timber piles which were driven nine for each pier and fifteen for each abutment.

Personnel

The contract was awarded to the Larson Construction Co. on its bid of \$32,840.60 for the overpass, \$83,322.45 for the embankment and \$92,061.46 for the 3-span bridge. T. J. Doyle was Superintendent for the contractor and R. S. Tillson, Resident Engineer for the Colorado State Highway Department.

An 8,000-mile All-Red-Route from Capetown to Cairo now enables motorists to penetrate "darkest Africa." The continent is also now spanned east and west by a road from Gibraltar to Cairo.



C. & E. M. Photo
The Unusual Column Forms Used By Larson Construction Co. Were Interchangeable and Served as a Ladder

Neil Jersey Becomes Vice Pres. And Gen. Mgr. of Riddell Corp.

Neil E. Jersey, who has been associated with the W. A. Riddell Corp. and its predecessors for the past twelve years, has been elected Vice President and General Manager of that corporation, to succeed H. F. Holbrook who died suddenly on June 24.

Mr. Jersey joined the W. A. Riddell Co. in 1924 to take charge of the designing, experimental and research department. In 1928 he assumed active charge of the road machinery sales department where his duties included the supervision of the engineering, manufacture and sales of Warco road machinery. In his new position, Mr. Jersey will have final jurisdiction over all matters pertaining to sales policy and will be assisted in road machinery sales by his former Assistant Sales Manager, C. A. Beal, who has been promoted to a newly created position, Manager of the Merchandise Bureau, in charge of

general office road machinery sales work, sales promotion and advertising.

W. G. Beebe, Secretary of the corporation, in addition to the duties of that office and those of General Office Manager, will take on the duties of Comptroller.

Tar and Asphalt Pumps

A new bulletin describing and illustrating the new RF three-lobe Cycloidal pump, which is particularly adapted to handling heavier liquids such as tar and asphalt, has recently been published by Roots-Connersville Blower Corp., Connersville, Ind. A table of capacities appears on page 2 of the bulletin, which also contains a description of Type SO for larger volumes as well as photographs of a number of typical installations.

Copies of this Bulletin 61-B10 may be secured by those interested by writing direct to the manufacturer and mentioning this magazine.

"IT'S SO SIMPLE . . .

● When Link-Belt announced the revolutionary new Speed-o-Matic shovel - dragline - crane about a year ago, up-to-date operators approved, in principle, but asked, "Will it work?"

Today they know the answer . . . it comes from every section of the country . . . a big, positive "Yes!" A full year of field service, under all working conditions, has proved that Speed-o-Matic has equaled and surpassed the claims made for it from the start.

Increased outputs of 25% or more are reported regularly. One Speed-o-Matic owner estimates as high as 60% increase in efficiency.

Users stress the simplicity and reliability of Speed-o-Matic control. Where they had thought a complicated set-up necessary for Speed-o-Matic's amazing results, they found merely a simple, practical, natural method of transferring the back-breaking effort of manipulating mechanical levers to operate the machine, from the operator to the power of the machine itself.

It's as simple as the hydraulic brakes on your car, and operates on the same principle. You never have to think about it. Send for Book No. 1795.

LINK-BELT COMPANY, 300 W. Pershing Road, Chicago
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By ending operator fatigue, Speed-o-Matic control increases output, reduces costs, and gets full efficiency from men and machines.



Development of Link-Belt Speed-o-Matic control puts manual-lever-operated shovels back in the class with automobiles you had to crank by hand.



Today you push a starter button in your car, drive farther and feel fresher at the end of the day. With the Speed-o-Matic control and its twist-of-the-wrist levers, you make more dirt "go places" all day without fatigue.

LINK-BELT

Speed-o-Matic

SHOVEL

DRAGLINE - CRANE

Improved Features For Line of Snow Plows

The 1937-38 models of the line of snow plows made by the Parsons Co., earlier models of which have been in use from coast to coast during the past six years, include a number of refinements rather than any change in basic design. One of the features of this year's plows is a reversible plow which will interchange the regular reversible moldboard with a standard one-way tapered moldboard of an improved type. This interchangeable feature is a convenience when varying conditions, either in the texture of the snow or wind conditions and drifting possibilities, make a rapid change from one type to the other desirable.

This company has also developed a new safety device for one-way and reversible moldboard types. This device was tested last winter and some improvements added which are designed to add to the safety of both the operator and

the plow. In the heavier types of plows, the power hydraulic device has some improvements in the power application and controls. Hand hydraulic power is standard on all Parsons plows but power hydraulics are available as an extra.

Literature describing the complete line of Parsons snow plows is now available to interested state and county highway engineers by writing direct to the Parsons Co., Newton, Iowa, and mentioning this magazine.

Portable Electric Tools Use Portable Power

Black & Decker portable electric tools for drilling, grinding, sawing, hammering and similar jobs required on construction projects in out-of-the-way places can now be operated by a portable gasoline-driven electric generator, as shown in the illustration. These tools are equipped with a universal motor, to operate on alternating or direct current,



A Black & Decker Electric Hammer Operated by a Homelite Portable Generator

from a portable generating plant or from central station electric current.

Complete information on the Black & Decker line of electric tools may be secured direct from the Black & Decker Mfg. Co., Towson, Md.

BUT WHAT AN IMPROVEMENT!"



Maintenance Outfit For Shoulder Work

It Is Part of the Creed of Arizona Highway Engineers to Keep the Shoulders Firm Against Pavement for Safety

IN District No. 3 of the Arizona State Highway Department they have taken a hint from the gas station operators who advertise "One-Stop Service." The highway engineers, however, make it a "no-stop" or "one-trip" job when it comes to the maintenance of the dirt shoulders along the paved highways. Out in Arizona they drive fast, distances are great, traffic not heavy, and the roads straight. Thus in the few instances when a car may be forced off onto the shoulder it is absolutely necessary that the shoulder be firm and tight against the pavement slab. There have been plenty of fatal accidents in other states which do not pay sufficient attention to this very important phase of maintenance.

The District 3 maintenance unit consists of an FWD truck with a pneumatically controlled pull-grader with the blade set to bring in the material from the slope beyond the level shoulder and windrow it at the outer edge of the shoulder. This is followed at once by a Galion patrol grader powered with an International 10-20 tractor and carrying a 16-foot blade. This patrol grader pulls the windrow across the shoulder and against the slab, even leaving some of the dirt on the pavement. Behind the patrol and pulled by it is a windrow eliminator which takes out the small line of material that works around the ends of the blade, leaving a perfectly smooth shoulder.

Then, so that there will be no dust or loose material to cause accidents, a rotary broom is pulled by the Galion patrol, cleaning the pavement and leaving a thorough job in one trip over the shoulder. This is repeated every few weeks so that the shoulders do not have a chance to become dangerous. With over 1,000 miles of highway in the District the outfit is kept busy continually.

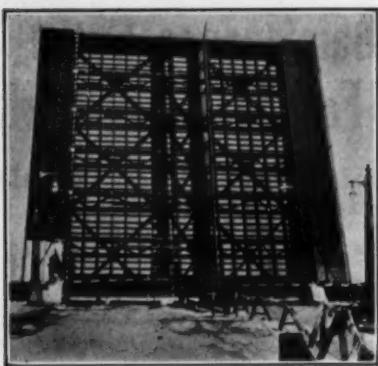
R. C. Perkins is District Engineer in the Third District with headquarters in Phoenix, Ariz., under T. S. O'Connell, State Highway Engineer.

New Catalyst Increases Workability of Cement

The use of a newly discovered dispersing and catalytic agent known as TDA in portland cement results in a concrete of greater workability which hardens rapidly and after hardening has a fine, uniform structure, homogeneous throughout. According to the engineers of the Dewey & Almy Chemical Co., Cambridge, Mass., which developed it, TDA by its dispersing action prevents agglomeration of the cement particles during the mixing process. This effect is enhanced by the catalytic action of TDA so that hydration is more rapid and bleeding is reduced.

Since bleeding is responsible for water gain under the aggregate in concrete, this means that concretes made from the new cement are far more impermeable and free from channeling, with resulting greater resistance to the ravages of freezing and thawing. Tests also show that the bond between the cement and the aggregate is much stronger when no water voids are formed under the aggregate during the hardening period.

TDA is added to the clinker in the final grinding operation during the manufacture of cement and it is claimed that it acts as a grinding aid during this operation, as well as a dispersing agent and catalyst during the mixing period.



The Rouge River Bridge Refloored with Steel Grating Applied by Arc Welding

Bridge Rejuvenated By Electric Welding

The Rouge River Bridge across the Rouge River near the Ford Motor Co. plant in Michigan was recently given a new floor. The old wooden blocks of the roadway and the planks of the sidewalk were replaced with steel grating applied to the bridge by electric welding.

The work was done by the Superior Welding & Brazing Co., of Detroit, Mich., with Lincoln arc welders and electrodes.

County Roads in Oregon Hit by Severe Winter

The roads of Clackamas County, Oregon, have been hard hit by the weather man, John L. Roberts, County Engineer and Surveyor, reports. The snow started on December 27, 1936 and continued through March, and the frost and thawing "did the roads no good." As a result, considerable money was spent this spring patching up the oil and rock roads, leaving little money for new work.

There are, however, a number of bridges to be replaced and about 50 miles of new roads which will be opened up this summer with graders and bulldozers. The county highway department hopes to add several miles of oiled roads to its program for next year.

This year the county added to its equipment six new International 3-ton trucks, seven pick-up trucks, a Caterpillar RD7 diesel tractor with bulldozer, a complete pile driver and bridge building truck with hoists, air compressor and augers for the holes that need to be drilled in any kind of bridge.

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Send for 56-Page Catalog of Latest Machines for All Types of Modern Roads.

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New Preformed Rubber Expansion Joint Filler

A new type of rubber expansion joint filler for joint openings in concrete highways, structures, curbs, sidewalks and similar types of construction has recently been announced by the B. F. Goodrich Co., Akron, Ohio. These preformed strips are made of rubber especially compounded for age and wear-resisting qualities. They are designed with flexible lips on both sides which project upward against the concrete surface of the joint opening, making their removal very difficult.

The strips are designed to be placed under partial compression as they are made about 25 per cent wider than the opening to be filled, permitting the rubber to follow the concrete as it contracts and yet compress readily when the concrete expands. In order that the strips may be easily compressed for placing in position, they are made with a large tubular opening in the center. The top

surface is slightly indented or grooved to provide for downward thrust of surface upon compression. Due to this latter feature, it is impossible for the joint material to extrude above the wearing surface of the pavement.

The recommended use is to place the strips in the bottom, ends and top of the joint opening which provides a rubber gasket around the entire cross section of the pavement or structure. To date in-

stallations of these preformed strips have been made in highways in Ohio, Indiana, Michigan, Tennessee, Georgia and the District of Columbia.

CP Buffalo Branch Moves

The Buffalo Sales and Service Branch of the Chicago Pneumatic Tool Co., New York City, has moved to 128 West Chippewa St., Buffalo, New York.

332 FLEX-PLANE MACHINES

During the first six months of 1937, 332 Flex-Plane Machines were used on road building jobs, including foreign countries.

Flexible Road Joint Machine Company
Warren, Ohio

LORAIN-40

carries
a
FULL
3/4
yard dipper



EVERY Lorain-40 dipper has 20¹/₄ cu. ft. struck measure capacity—based on the standards of The Shovel and Crane Manufacturers Association... Full dipper measure and Full shovel value explain why 2 in every 5 Lorain-40 sales are repeat orders.



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THE THEW SHOVEL COMPANY
LORAIN . . . OHIO

Pennsylvania Authorizes 165-Mile Toll Road

A bill creating the Pennsylvania Turnpike Commission and authorizing the construction of a 165-mile toll road between Harrisburg and Pittsburgh has been passed by the Pennsylvania Legislature and approved by the Governor. This project was initiated by the Department of Highways and a field survey was undertaken through the medium of a WPA project, the WPA furnishing the members of the survey parties, and the Highway Department furnishing the supervision, paying subsistence and expenses, and furnishing the equipment involved.

It is anticipated that the road will be a four-lane highway, with nine tunnels under the principal ranges of the Allegheny Mountains, the purpose of the new route being to provide an all-weather through highway on a more level grade than any now existing in the mountainous state of Pennsylvania. The proposed road will have a maximum gradient of 3 per cent and a maximum degree of curvature of 6 degrees, or with a 955-foot radius, thus providing a maximum of sight distance.

The Pennsylvania Turnpike Commission is authorized to issue revenue bonds and from the proceeds of such bonds to construct the highway. It is further authorized to fix the necessary rates of toll and operate the highway as a toll road after completion. The proceeds from tolls will be devoted to providing the necessary cost of operation and maintenance and the sinking fund requirements necessary to retire the revenue bonds so that after a period of time the road will have paid for itself and then will be turned over to the State as a free state highway.

It is estimated that the cost of the construction of this highway will be about \$50,000,000. It will require 770,000 tons of sand, 1,200,000 tons of stone and slag, 50,000 tons of steel, and 392,000 tons of cement.

Cartwright Amendment Defeat Shows Need to Fight for F-A

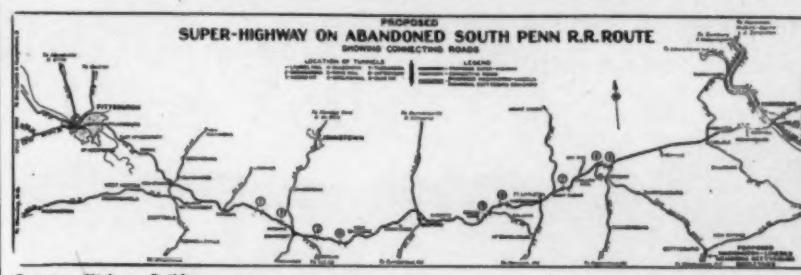
The Relief Bill, minus the Cartwright Highway Amendment which was defeated in the House by only twenty votes, has been passed by both branches of Congress in accordance with the request of the President. The most outstanding amendment to the Bill as passed is the one introduced by Senator Hayden which extends the Public Works Administration for two years. The defeat of the Cartwright Amendment cost the highway program \$150,000,000 additional funds.

While the regular highway program is in good shape for the year, the action on the Cartwright Amendment indicates that all those interested in good roads must line-up their forces in order to put through the Federal-Aid measure which will come up for consideration next January.

The consideration of the Cartwright Amendment accomplished one thing, however, which will be of great help in securing the necessary Federal Aid next year and that is a greater interest in the value of an adequate highway program. This amendment held the Congressional spotlight for several days and without doubt a larger number of Representatives now realize the importance of highways than ever have in the past. This support will be needed at the next session of Congress.

In a letter to Charles M. Upham, Engineer-Director of the American Road Builders' Association, thanking him and his associates for their support of his Amendment, Mr. Cartwright said:

"Any temporary disappointment which road enthusiasts may feel because



this effort to secure additional road funds from emergency appropriations was unsuccessful should not cause any of us to lose sight of the fact that the Federal Government is now appropriating on a regular basis, as in the Hayden-Cartwright Act passed in June, 1936,

more money for highways than at any other time in history—nearly a quarter of a billion dollars a year—and the important thing is to continue the sound and effective highway program under which steady, if slow, progress is being made, in cooperation with the states, in

building a national system of connected all-weather roads."

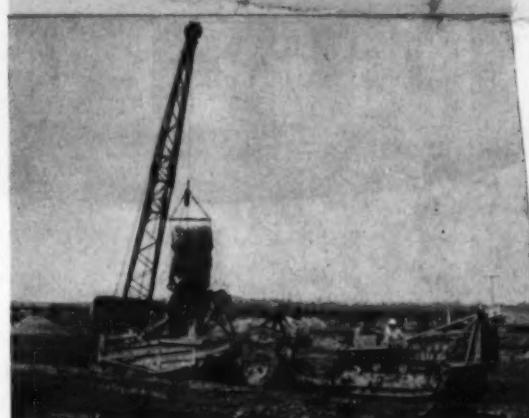
New Construction Booklet

A pictorial record of Caterpillar tractors, road machinery and engines on various types of construction jobs is contained in the new 32-page booklet "On Construction Jobs with Caterpillar Products." Equipment such as shovels, crushers, dredges, hoists, etc., powered with Caterpillar engines are illustrated, as well as Caterpillar road machinery and various types of construction equipment mounted on Caterpillar tractors.

Copies of this interesting booklet, Form No. 4198, may be secured gratis direct from the Caterpillar Tractor Co., Peoria, Ill.



U-12 Carryall and "Caterpillar" R-6 loading muddy clay from the borrow pit.



LeTourneau U-12 Carryall Scraper being loaded by a Lorain 1-Yard Dragline at Sardis.

U-12 Carryall going through the spongy fill where other equipment bogged down.



GOOD MUDDERS LeTOURNEAU CARRYALL SCRAPERS

Down in the wet clay of Sardis Dam, Mississippi, Fred Hooper (Hooper Construction Company), LeTourneau fleet user, has a million yards of excavation to move in 150 days. When his hauling equipment stuck in the spongy fill, he loaded LeTourneau U-12 Carryall Scrapers with a dragline, used them as hauling units until their big 18.00 x 24 tires had compacted the fill sufficiently to make it passable for conventional wagons and trucks. Then they went back to loading themselves, continued hauling, spreading and compacting the fill so other equipment might work. Thus at Sardis Dam, LeTourneau Carryalls showed themselves good mudlers, definitely proved they will go where ordinary equipment finds the going too soft.

If you have a mud job, ask your "Caterpillar" dealer to demonstrate what LeTourneau equipment will do.

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Road Needs Ferry Two Months a Year

When we asked D. R. Savage, County Engineer of Aitkin County, Minn., what his No. 1 problem was for 1937 construction, he came back instantly with "How to build and maintain a gravel road over muskeg." For those of you who do not live in sections of the country which have this peculiar swampy formation, muskeg generally refers to a rocky basin filled by successive deposits of unstable material, such as leaves, muck and moss, incapable of sustaining much weight. In some sections it refers to any large mud hole.

The particular muskeg to which Mr. Savage refers is under one or two feet of water for at least two months every spring. In crossing this unstable area, the road is carried on corduroy over which there is a fill of about 3 feet of clay and a surface of gravel. If the fill is increased in thickness, the highway sinks.

Every spring when the Willow River goes on a rampage, school buses, logging trucks and dairy trucks need navigators as well as truck drivers. In the photograph the boat which is used to ferry school children across this flooded section is shown pulled up on the road at the edge of the swamp. It is possible to build a detour around this section, according to Mr. Savage, "but who wants to build one road for two months travel and leave another for the other ten months?"

New Line of Trailers For Heavy Machinery

A new line of machinery trailers, equipped with pneumatic tires, for heavy-duty service, the features of which are greater strength, flexibility, and ruggedness, has just been announced by the C. R. Jahn Co., Builders Bldg., Chicago, Ill., which for the past five years has manufactured exclusively a general line of standard machinery trailers.

Capacities of the new line of trailers from 5 to 50 tons are available, either in full or semi-trailers. Three different frames are offered, drop, light kick-up, or flat platform, and practically all state regulations are conformed with by the overall widths, lengths and wheel designs of the entire line. All castings are of electric cast steel. The strength and rigidity in the frame is said to be accomplished by using deeper main



When Willow Creek in Aitkin County, Minn., Goes on Its Spring Rampage, School Children and Even Cans of Cream Have to Be Ferried Across That Section of the Road

beam sections and a greater number of cross members, without increasing the trailer's weight.

Dual-type wheels of cast steel, heavily reinforced, roll on oversized tapered roller bearings. The small diameter of the wheels keeps the trailer bed low for easy loading and handling. The num-

ber of wheels varies from four to twelve, according to the trailer size. Those in the rear are arranged on single, tandem, or dual-tandem axles, whichever is required. In the tandem axle design, the wheels are mounted on a special rocker arrangement to assure even distribution of the load at all times. Oscillating

front axles on the trailers of lower capacities are claimed to provide a flexibility which helps relieve the frame members of strains and stresses. In the heavy-duty trailer, the large diameter fifth wheel is mounted on heavy silicon-manganese-alloy steel springs. Brake drums are cast integral with the wheels, and the internal expanding brakes are operated by brake wheel or lever. Vacuum or air power brakes are also available.

Standard equipment on all trailers includes loading ramps, lash rings, and Alemite or Zerk pressure grease fittings on moving parts. Safety chains are furnished on all full trailers. Side extension brackets, electric lights and reflectors, side loading ledges, push bar attachment on rear, lower fifth wheel for semi-trailers, and special paint jobs and lettering are all available as extras.

Complete details on this new line of Jahn trailers may be secured by those interested direct from the manufacturer by mentioning CONTRACTORS AND ENGINEERS MONTHLY.



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FOR MODERN ROADS & STREETS

Truscon Steel Reinforcing Products for concrete pavements provide adequate provision for control of expansion, contraction, increasing traffic loads, frost action on sub grades and other destructive forces. Maintenance costs of **TRUSCONIZED** roads and streets are kept low with resultant savings that accumulate rapidly. • Armor roads and streets with Truscon

Steel Reinforcing Products and safeguard modern highways against "shell holes," spallage, faulted joints and slab ends, buckling, cracking and infiltration of inert material. • Truscon engineers offer full cooperation in all details pertaining to the successful installation of Truscon Steel Products. • Write for your catalog and complete detailed information, now!

LOAD A PAIR of These Handy Barrows on the Elevator Hoist at ONE Time



**F-4½ BARROW
WITH PNEUMATIC TIRE**

Easy loading or dumping; correct width for hoisting 2 barrows at once; deep tray for very wet concrete or mortar. Never-slip type axle, 16" wheel, with ball bearings; hardwood handles; reinforced frame; strong channel-iron legs. Capacity 4½ cu. ft. (dry measure). A money-saver. WRITE for bulletin L-12, and costs.

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Trusconize**

TRUSCON STEEL COMPANY

YOUNGSTOWN . . . OHIO

Asphalt as Stabilizing Agent for Clay Soils

Tests and Procedure for This Type of Low-Cost Road Described in Detail

THE use of bituminous materials for the stabilization of sandy soils was discussed in an article in the July issue of CONTRACTORS AND ENGINEERS MONTHLY. Bituminous material as a dust palliative has been used on sandy soils since 1904 but when this treatment was adapted to clay soils, it was only partially successful, principally because no effort was made to obtain any substantial thickness, and with moisture saturation under winter conditions, thin mats soon broke through and the treatment gave but little cumulative benefit.

In the past few years numerous experiments have been made by mixing liquid bituminous products with the natural soils to greater depths, 2 to 6 inches, and definitely changing their character so that they become highly resistant to water. In a paper before the American Road Builders' Association last January, Bernard E. Gray, Chief Highway Engineer, The Asphalt Institute, pointed out that several elements in such mixing have been soundly established: (1) the addition of soil particles coarser than 200-mesh whenever available, which add internal strength and also reduce the surface area to be coated; (2) the presence of a certain amount of moisture is desirable to facilitate mixing and coating; (3) in finely divided clay soils all particles need not be coated so long as the capillary character is destroyed; (4) there should be careful preparation of the soil so that it is uniform in composition and well broken up into a mellow condition similar to a field before seeding; and (5) the invariable application of a light seal coat after the mixing and consolidation has been accomplished is essential.

The use of a membrane of tough bituminous material placed entirely across the subgrade at some predetermined depth to serve as a cut-off barrier against the rise of capillary moisture is an invention of recent years. The surface also is treated with bituminous material, thus effectively enclosing a slab of earth with a water-proof coating. The layer of earth may be either untreated but at its optimum moisture content, or it may be a mixture of soil and bituminous material as described under the preceding paragraph. The membrane itself is composed usually of a heavy asphaltic material applied hot and in such amount as to form a layer approximately $\frac{1}{2}$ inch in thickness.

In many areas where clay soils are found, the availability of coarser aggregates is limited, and stabilization of the soil with asphaltic materials alone is receiving increasing attention, either to serve as wearing courses or as durable bases for relatively thin pavements. There are two principal methods of treatment, one the subterranean treatment or "sub-oiler" method, the other the mixing method. The latter may be by the road-mix process or by plant-mix.

Subterranean Method

This method provides for deposition of a quantity of liquid asphaltic material at the bottom of a scarified layer of earth, followed by compaction to induce permeation of the overlying soil and thus produce a waterproofed layer of substantial thickness.

The depth to which the soil is scarified may vary from 3 to 6 inches, depending upon the inherent strength of the soil

and its capillarity. A variety of equipment may be used for this preparation, but as a rule the scarifier attachment on motor patrol graders is adequate, although for relatively dry surfaces, tractor-drawn scarifiers may be more efficient for the first breaking. Further pulverizing should be done with harrows and both the disc and tooth harrows may be used. The more uniform the texture of the scarified soil, the better and more even will be the diffusion of the bituminous material. Also the preparation is facilitated by the presence of enough moisture to make a mellow condition, such as occurs in late spring months.

The sub-oiling equipment consists of a heavy frame supporting a number of hollow curved teeth which project down

to the desired depth and through which the asphaltic material is forced by a pump. Usually a distributor is used as the supply, a hose connection being made to the oiler. The sub-oiler is usually hauled by a tractor, according to conditions, and the distributor, sub-oiler and tractor move along together as a unit until the tank is empty.

While this method has been applied to nearly pure clay and silt soils, the addition of some form of granular material prior to scarifying is helpful in adding internal friction and reducing the amount of asphaltic material required. This granular material may be dirty sand or aggregate otherwise unsuitable for construction purposes, its value appearing to be more a matter of size of particles than any other property. Two or three weeks usually elapse before the bituminous material comes through to the surface, the final stage of diffusion often occurring after rain.

Liquid asphaltic products such as medium-curing cut-back asphalts, and various kinds of emulsified asphalts

have been used in this process, and quantities required vary from 3 to 7 per cent by weight of the mass of soil to be impregnated. This is at the rate of 0.5 to 0.8-gallon per square yard per inch of depth. Recent studies indicate that with some clays it is not necessary to do more than stain the soil, just so long as this lesser amount destroys its capillarity. In other words, the application of even a very small amount of bituminous material may reduce the plasticity index and thus maintain the bearing power of the soil over longer periods of wet weather than when untreated.

During the period of diffusion the surface is maintained by blading, the motor patrol grader being a good piece of equipment for this purpose. No mixing is done, simply the surface kept smooth as in ordinary earth road maintenance. This same maintenance is continued after diffusion is completed until the surface is uniformly compacted and even in appearance.

(Continued on page 39)



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10 times more Diesel Service Hours!

Are you getting the full output that your "Caterpillar" Diesel Engine or Tractor will give?

You'll get highest performance and also cut operating costs by using Ten-ol, the new, fused lubricant developed by Sinclair for "Caterpillar" Diesels.

Operators are finding that Ten-ol practically ends lubricating troubles, and gives ten times more "Caterpillar" Diesel service hours than

the finest straight mineral oil. It does so because in its development Ten-ol was required to meet lubricating conditions more severe than any that the toughest actual service can impose.

Order Sinclair Ten-ol, Sinclair Diesel fuel, and other Sinclair products from your local Sinclair office, or write Sinclair Refining Company (Inc.), 630 Fifth Avenue, New York, N. Y.

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Sinclair TENOL is recommended as a "new outstanding Diesel engine lubricant" by Caterpillar Tractor Co.

Arc Welding Handbook

The fourth edition of "Procedure Handbook of Arc Welding Design and Practice" recently published by the Lincoln Electric Co., contains the latest weld symbols adopted by the American Welding Society in May, and a new introduction to Part 6 on designing for arc welded steel construction of machinery. The addition of this new material at this time is in line with a policy of supplying to the arc welding industry the latest and most important information.

The book, now containing 839 pages

and over 1,000 illustrations, including photographs and drawings, may be secured from the Lincoln Electric Co., Cleveland, Ohio. Price: \$1.50 postpaid.

Who's Who in Engineering

The fourth edition of Who's Who in Engineering, the biographical dictionary of the engineering profession, edited by Winfield Scott Downs, has just been published by the Lewis Historical Publishing Co. As in previous editions, the qualifications for inclusion in this vol-

ume are outstanding and acknowledged professional eminence; at least ten years active practice, five of which must have been in responsible charge of important engineering work; or a position on the staff of accepted schools and colleges for ten years, at least five years of which have been in responsible charge of a major engineering course.

This latest edition, which is a more comprehensive and exact picture of the personnel of the engineering profession in all its branches than has ever been made before, contains the professional records of 12,000 engineers.

Copies of Who's Who in Engineering may be secured from the Lewis Historical Publishing Co., Inc., County Trust Bldg., Eighth Ave. at 14th St., New York City. Price \$10.00.

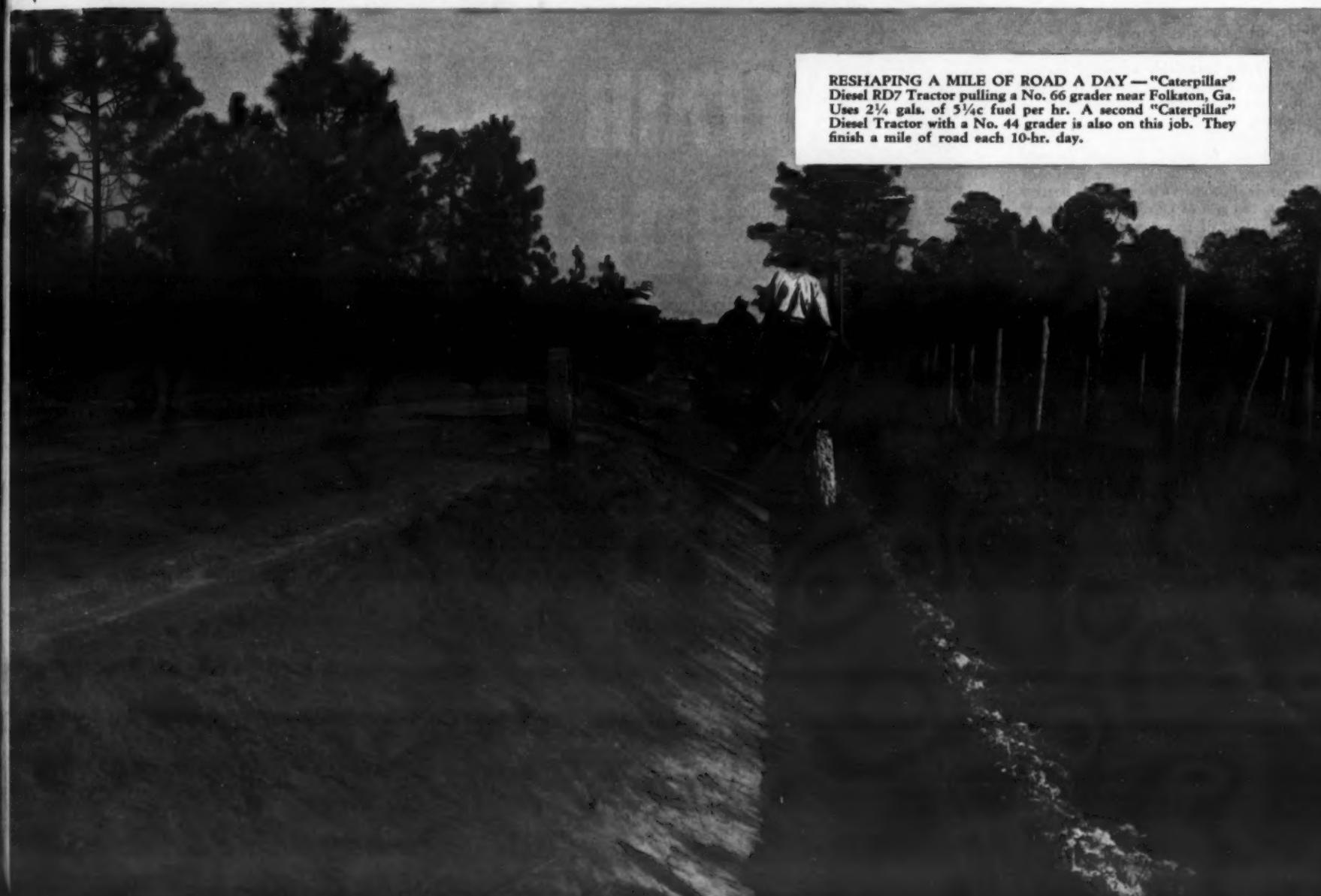
McGuire Joins Harnischfeger

L. T. McGuire, for eighteen years Assistant Sales Manager for the Byers Machine Co., has joined the Harnischfeger Corp., of Milwaukee, Wis., as Divisional Manager of the Large Excavator Division.

All Seasons TO "CATERPILLAR" DIESEL TRACTORS

Caterpillar Diesel Tractors and Auto Patrols equipped with snow-plows take blizzards in their stride. They are the first to break trail following a heavy snow. In summer, the tractors and Auto Patrols construct and maintain roads. A year-round investment that pays big dividends. Counties and townships find that these machines operate on the lowest cost fuel available, return generous profit to the taxpayers. Mail the coupon for two free books on road construction and road maintenance. See what other communities are doing with Diesels.

RESHAPING A MILE OF ROAD A DAY — "Caterpillar" Diesel RD7 Tractor pulling a No. 66 grader near Folkston, Ga. Uses 2½ gals. of 5½c fuel per hr. A second "Caterpillar" Diesel Tractor with a No. 44 grader is also on this job. They finish a mile of road each 10-hr. day.



Crushing Equipment Book

Booklet No. 5371, describing and illustrating the complete line of Good Roads machinery for rock quarries and sand and gravel pits, has just been issued by the Good Roads Machinery Corp., Kennett Square, Penna. In addition to detailed descriptions and specifications of the various sizes and models of crushers, vibrating and revolving screens, material conveyors, wash boxes and complete crushing and screening plants, this new 30-page booklet contains a number of interesting photo-

graphs showing typical installations. Copies of this booklet may be secured direct from the manufacturer, by mentioning this magazine.

Roadside Development Report Of Highway Research Board

A report on roadside development, covering the work accomplished during 1936 by the Joint Committee on Roadside Development of the Highway Research Board and the American Association of State Highway Officials, has been

published by the Highway Research Board of the National Research Council.

Among the subjects covered are the history and purpose of roadside development work, surveys and plans for a comprehensive roadside program, control of erosion, grading operations, drainage, types and methods of planting, and public relations, and current practice in the various states with regard to shoulders, ditches and back slopes is summarized from the results of questionnaires.

Intended for use as a reference by those working in the field of roadside improvement, copies of this Report may

be secured from the Highway Research Board, Washington, D.C. Price: 25c.

Belgian Highway Lighted

The highway between Brussels and Antwerp, the two largest cities in Belgium, is now completely equipped with overhead lighting, about 800 mercury and 750 sodium vapor lights being in use. About 25 miles in length, this is reported by the U. S. Bureau of Foreign and Domestic Commerce to be the longest lighted highway in Europe.

Look-Alike



20 CENTS A MILE — "Caterpillar" Diesel RD7 Tractor and snow-plow clearing 4-ft. snowfall atop Gore Pass Road across the Gore Mts., near Yampa, Colo. This is the gateway to the Western Slope cattle and coal country. Outfit clears 15 miles a day, using 25 gals. of 12c fuel per 8-hr. day.

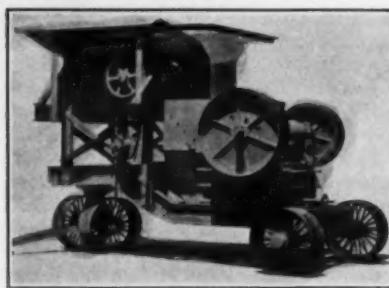
CATERPILLAR



WORLD'S LARGEST MANUFACTURER
OF DIESEL ENGINES, TRACK-TYPE
TRACTORS AND ROAD MACHINERY

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CLIP AND MAIL THIS COUPON NOW
CATERPILLAR TRACTOR CO., Peoria, Ill.
Gentlemen: Please send me your books on road construction
and road maintenance.
Name _____
Title _____
Address _____



A Universal Mobile Crushing Unit

New Crusher Unit Has Portable Apron Feeder

An unusual feeder crusher unit recently developed by the Universal Crusher Co., Cedar Rapids, Iowa, for a large high-production rock crushing operation involves the use of a Universal primary jaw crusher mounted on a portable rig with an apron feeder mounted above it. This apron feeder is designed not only to speed up output by maintaining a steady flow of rock into the crusher but also to save time by eliminating the necessity of setting up and dismantling stationary feeders.

This combination of crusher and feeder mounted on a single mobile unit is made to operate in conjunction with a similar crushing unit on which is mounted a roll crusher for secondary crushing. A belt conveyor carries the primary crusher rock from one crusher to the other, a second conveyor unit handling the final product to temporary storage bins.

Bridge Awards Announced

Selected to receive the stainless steel plaque of the American Institute of Steel Construction designating them as the most beautiful bridges of monumental size, medium size, and small span completed last year are the East River Crossing of the Triborough Bridge, New York City; Hurricane Deck Bridge, Lake of the Ozarks, Missouri; and Astoria Boulevard overpass over Grand Central Parkway Extension, New York City. Because of the unusual number of excellent bridges in the monumental size group, the decision of the Jury was a difficult one to make and three bridges in this group were selected for special mention: the Henry Hudson Bridge, New York; the West Bay Crossing of the San Francisco-Oakland Bay Bridge, and the Fore River Bridge between Quincy and Weymouth, Mass.

The Jury of Award included Harvey Wiley Corbett of the architectural firm of Corbett & MacMurray, New York City; Leonard Schultze, architect, of New York City; Clarence W. Hudson, consulting engineer, New York City; Robert Ridgway, consulting engineer, also of New York City; and A. Lawrence Kocher, Editor of Architectural Record.

The winner of first place in the Class A group, the East River Crossing of the Triborough Bridge in New York City, was constructed at a total cost of \$8,500,000 by the Triborough Bridge Authority, O. H. Ammann, Chief Engineer; Allston Dana, Engineer of Design; and Leon S. Moisseiff, Consulting

Engineer. The bridge was fabricated and constructed by the American Bridge Co., Bethlehem Steel Co., and the American Locomotive Co. It has a span length of 1,380 feet and is 113 feet wide.

The Hurricane Deck Bridge across Sage Arm of the Lake of the Ozarks on Missouri Route 5, Camden County, Mo., winner of first place in the group of medium-size bridges, has three central spans each 464 feet long and two side spans each 377 feet. Sverdrup & Parcel were the engineers, Stupp Bros. Bridge & Iron Co. fabricated the structural steel and subcontracted the erection to the Wisconsin Bridge & Iron Co. The cost of the structure was \$656,204.89.

The Astoria Boulevard overpass in Queens County, New York City, which received first place in Class C, was designed by engineers of the Long Island State Park Commission and Triborough Bridge Authority and was constructed by the American Bridge Co. It cost \$114,000.

This is the ninth annual award made by the American Institute of Steel Con-

struction for the most beautiful bridges built of steel. Those structures receiving the award will be decorated with stainless steel plaques in commemora-

tion thereof and certificates of award will be given to the engineers, architects, designers, fabricators and builders.



Good Engineering and Good Products Make Good Roads



Socony Asphalt Penetration Macadam, Standard Brand, Connecticut State Highway, Old Mystic, Connecticut.

Socony Asphalt Road Oils • Socony Asphalt Joint Fillers • Socony Waterproofing Asphalt • Socony Cut-Back Surfacing Asphalt • Socony Asphalt Binder A for surface treatment • Socony Refined Asphalt for sheet asphalt paving • Socony Cold Patch Asphalt for all types of patching • Socony Asphalt Binders B & C for penetration work (Asphalt Macadam) • Socony Paving Asphalt 51-60 and 61-70 Penetration for the mixing method (Asphaltic Concrete) • Specifications and all other particulars furnished on request.



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INCORPORATED
STANDARD OIL OF NEW YORK DIVISION

WILLIAMS FORM CLAMPS

It costs 8¢ per cu. yd. of concrete for rod replacement in using Williams Clamps on a form design of 800 lbs. pressure per sq. ft. Compare this with the cost of your present ties—and you will be added to our list of satisfied customers.

Order today—24 hr. service—send plans for rod layout.

Williams Form Engineering Corp.
1244 Prospect Ave., S. E.
Grand Rapids Michigan

Electric Current on the Job

Kohler electric plants, in a variety of sizes and models to meet the varying requirements for electric current on construction jobs, are described in a recent bulletin "Kohler of Kohler Electric Plants" issued by the Kohler Co., Kohler, Wis. These plants range in size from 800 watts to 10 kw, in ac or dc models, for gasoline or fuel oil.

Copies of this bulletin, and complete information on the type and size of Kohler plant which will best meet the requirements for electric current on

your job, may be secured direct from the Kohler Co. by mentioning this magazine.

New Tractor Catalog

An attractive well-illustrated catalog, describing Allis-Chalmers Model LO oil tractors and depicting their use by contractors and highway departments, has recently been issued by the Allis-Chalmers Mfg. Co. Large illustrations show action scenes on construction jobs, as well as cross section views and features of construction of these tractors. The controlled-ignition diesel-fuel-burning

engine used in Allis-Chalmers equipment is described in a clear, concise manner.

Copies of this new booklet may be secured by interested contractors, state and county highway engineers and tractor operators direct from the Allis-Chalmers Mfg. Co., Tractor Division, Milwaukee, Wis., by mentioning this magazine.

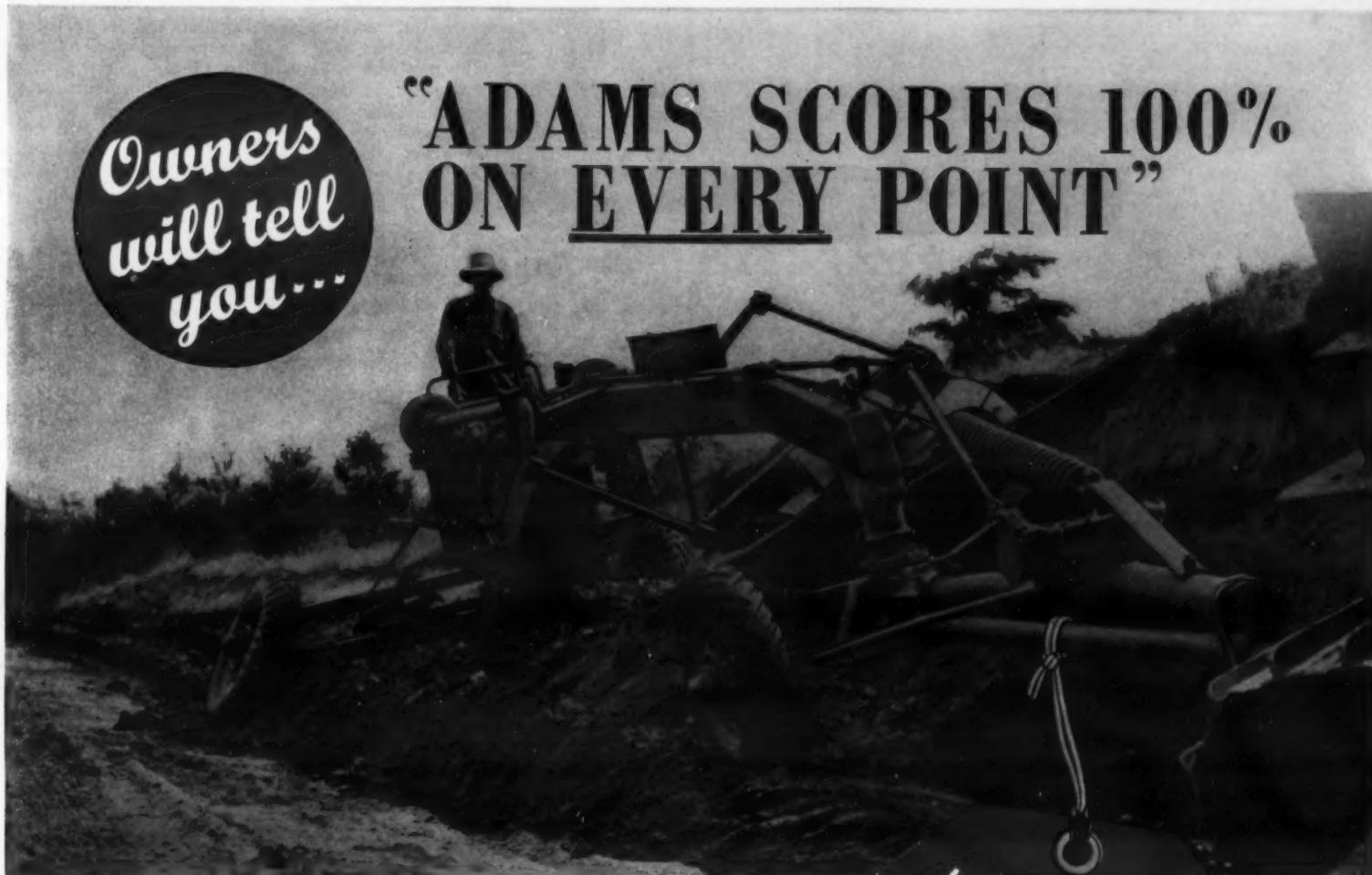
Mass. May Lose Federal Aid

The penalty of the Hayden Cartwright Act may be invoked against Massachusetts because of the diversion of

special highway revenues to other than highway purposes, according to a recent article in the *Boston Post*. It is estimated that if the penalty is invoked the loss to the state in Federal Aid may amount to about \$3,000,000.

New Rubber Goods Dealer

New York Belting & Packing Co., Passaic, N. J., has announced the appointment of the Whittle Hose & Rubber Co., 549 W. Randolph St., Chicago, Ill., as distributor for the complete line of N. Y. B. & P. mechanical rubber goods in the Chicago district.



NO LINE of road machinery has ever met with more widespread popularity and praise than Adams "monomember" leaning wheel graders. Their extremely wide range of blade adjustments, their quick adaptability to every job, their easy operation, their capacity for hard work and the vast amount of time which they save on all types of work is common talk among owners and operators everywhere. Hundreds of users marvel at the strength of Adams narrow, box-type frame—adequate for every need... Most of these owners investigated and are entirely familiar with every other well known make of grader on the market and they will tell you without hesitation that Adams graders have no equal.

In their third year of "making good" under every conceivable condition these new graders in 12, 10, and 8 ft. sizes are scattered all over the map. Before buying your next grader, let your local Adams representative show you one or more in action. If you don't know his address, just drop a post card to

J. D. ADAMS COMPANY • Indianapolis, Indiana
Branches, Representatives and Distributors Throughout United States

- ✓ STRENGTH
- ✓ RIGIDITY
- ✓ VISIBILITY
- ✓ ADJUSTABLE WORKING POSITIONS
- ✓ QUICK ADJUSTMENTS
- ✓ EASY OPERATION
- ✓ DURABILITY
- ✓ LOW UPKEEP COST

ADAMS • *New-Type Leaning Wheel* **GRADERS**

Geiger Grade Made Into Modern Highway

(Continued from page 2)

has many curves to enable it to keep within the 6 per cent grade limits.

Making the Largest Cut

The story of the largest cut is interesting because it is typical of the work done all through the project. This largest cut was 700 feet long and had a maximum height of 62 feet on the uphill side. The slope of the solid rock hillside was 38 degrees which would not permit any men to work safely without the aid of ropes from above.

The work was started by shooting a light trench about 10 feet deep and leaving the material so that all later blasting could be done against this first bank and save the material. Only 500 to 600 yards of rock was lost in the deep gulch below. The top of this cut was sloped but it was found that the path of any loose rocks that might work free above the top of the cut was directly to the middle of the road. To overcome this hazard an additional 3,000 yards of rock was removed at the top so that the rocks now drop on the inside of the road and cause no harm.

Since the rock in this section air-slakes, it was necessary in most of the cuts to take the back slopes farther away from the road than originally planned. The headwalls of all the culverts were carried to grade instead of leaving them horizontal.

On all the earth fills there is an earth parapet 1 foot high, 2 feet wide at the bottom and 1 foot wide at the top to assist cars to keep in the roadway. There is no guard rail used on the entire project.

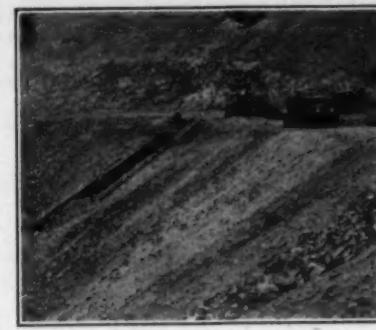
Equipment

While a great deal of the work was done with hand labor there was a large amount of hard rock work and large volumes of earth had to be moved which required heavy equipment. These machines included: two LeTourneau 14-yard Carryall scrapers pulled by a pair of Caterpillar diesel Seventy-fives; a Marion 1 1/4-yard gas-electric shovel; a 1 1/4-yard Northwest gas-powered shovel; four 220-cubic foot Ingersoll-Rand gas-powered compressors and one I-R 330-foot diesel compressor; and 20 jack-hammers divided between Ingersoll-Rand and Gardner-Denver. On the lower or northern contract standard steel was used for drilling while on the upper end Timken detachable bits were used.

About 90 tons of explosives were required to remove the heavy rock cuts and this was divided between black powder and 25 per cent quarry special, 40 tons of the former and 50 tons of the latter. There was 124,810 cubic yards of unclassified roadway excavation in the upper contract and 143,600 yards in the lower.

Gravel Crushing Plant

The contractor for the gravel surfacing set up a Bodinson crushing and screening plant at the bottom of the new grade in a tested gravel pit. The plant produced 1,500 tons of material in 8 hours. The material was excavated



A 48-Inch Asphalt-Coated Culvert Pipe, Showing the Method of Carrying It Down the Slope, Before Covering with Rock

by a Northwest shovel and loaded into three shuttle trucks, all Fords, while the finished material was hauled up the grade by a fleet of eleven 9-ton Mack trucks. The plant contained a vibrating scalper and a Symons 3-inch cone crusher. The plant was worked during two 8-hour shifts.

A feature of all new work in Nevada is the treatment of borrow pits after the contractor has finished with them. He is required to trim them up, bury all oversize rock, leave all back slopes on a 2 to 1 bank and generally leave them so they will not be a blot on the landscape. The 2 to 1 back slope was decided upon as it permits cattle to enter the pits without danger of broken legs. The bottom of the pit is left level. The contractor is also required to blot out completely all construction roads.

Personnel

The contractor for the upper 3-mile section of the new Geiger Grade was the Utah Construction Co., of Ogden, Utah, for which Waite Bruce was Superintendent. The Isbell Construction Co., of Reno, Nevada, was the contractor for the lower 4.45 miles with C. V. Isbell, a member of the company, acting as Superintendent. This same contractor was awarded the contract for the selected material and gravel surfacing of the entire project. C. A. Springmeyer was

Resident Engineer for the Nevada State Highway Department.

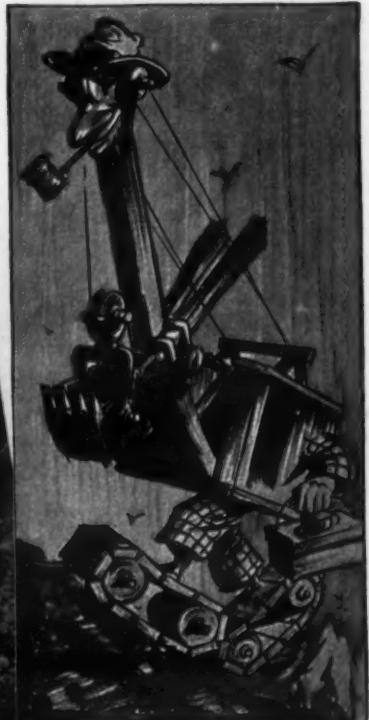
New Models of Snow Plows For Motor Trucks Announced

The Baker Mfg. Co., of Springfield, Ill., is bringing out several new models of snow plows for motor trucks, including a one-way snow plow equipped with Baker tripping blades, to be known as Model 187 Landside. A new Model 161, a V-type plow, rounds out the line of plows built for use with 1 1/2 to 2-ton motor trucks.

New and improved models of plows have also been developed for speed patrol graders and for the heavier tractors which will have many added practical features for easier operation and more efficient performance.

Many advance orders have been received for snow removal equipment by the Baker Company who ship snow plows every month in the year, in addition to its road-building equipment.

A SHOVEL CAN'T WALK 46 MILES TO WORK WITH PAPER HORSEPOWER...



A 190 hp. Model 6-EKH Waukesha-Hesselman Oil Engine powers this Link-Belt K-48, 2 cu. yd. Speed-o-Matic Shovel in the service of the Stonewall Gold Mining Company in Montana.

It takes REAL HORSEPOWER TO CROSS THE CONTINENTAL DIVIDE

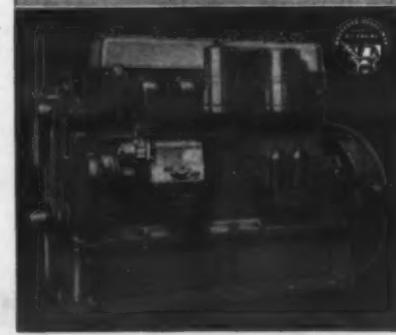
Before this Link-Belt shovel could go to work digging placer gravel, it had to take a 46-mile walk under its own power from Silver City to the mine on Stonewall Creek at Lincoln, Montana.

This meant crossing the Continental Divide—6,600 feet above sea level—over narrow, winding roads—up steep hills—around a dozen bridges. And then there was that deep creek at Woburn. Shovels had crossed it before—but only with cable block and tractors. But the Link-Belt service man knew his shovel... and he had confidence in its Waukesha-Hesselman Engine. It took the shovel down a twelve-foot bank and up a shale rock slide on the other side—a forty-degree angle up and a ten-degree angle sidewise—and made it across in twenty-five minutes.

Whether it's going to the job on the roughest road—or on the job with the toughest digging—the Waukesha-Hesselman is all real horsepower, not paper horsepower. A low compression, solid injection oil engine, with precisely timed electric ignition, it burns low cost, high speed diesel fuels. Upkeep is lower than with high pressure Diesels. Write for Bulletin 918.

WAUKESHA MOTOR COMPANY, WAUKESHA, WISCONSIN
NEW YORK • TULSA • LOS ANGELES

WAUKESHA
ENGINES



SAND'S-STEVENS Line & Surface LEVEL



Endorsed and adopted by Road Builders and Contractors

Level is easily and quickly attached to line. Special feature construction prevents accidental detachment from line. Construction is sturdy, and accuracy, guaranteed.

SAND'S LEVEL & TOOL CO.
8631 Gratiot Ave. Detroit, Mich.



One of the New Rogers Bros. Heavy-Duty Trailers, Owned by the Campanella Construction Co., Inc., Transporting a Thew-Lorain 75A Shovel

Soil Stabilization With Portland Cement

Initial experiments with portland cement soil mixtures in South Carolina were discussed by W. H. Mills, Jr., Testing Engineer of the State Highway Department, at the Sixteenth Annual Meeting of the Highway Research Board. This work led in October 1933 to the moulding of samples in the driveway of the laboratory to learn their resistance to weather and traffic. These samples, consisting of top soil and rich sand clay soil were used with varying amounts of cement. Their resistance to traffic was noticeably greater than that of raw soil.

The first field experiment, a 528-foot section of road in good sand clay, was constructed in December 1933, the soil in place being pulverized and cement applied to the surface at the rate of one bag per linear foot of 20-foot roadway. Cement and soil were mixed dry, sprinkled, mixed wet, shaped and rolled. After being under traffic for one year, the road was covered with a 1-inch sheet asphalt wearing course. A few pot-holes developed, but there was no indication of raveling or general breakdown.

In the spring of 1935 a test section, known as the Johnsonville Experiment, was undertaken with preliminary laboratory study of soil compaction and of the resistance of soil-cement mixtures to repeated wetting and drying, freezing and thawing. From the laboratory tests and experience on previous experiments it was decided to use 6 per cent by weight of cement in most of the field work, although 4 per cent was considered sufficient on 2,500 feet. Allowances for unknown loss in placing and mixing made it advisable to increase these percentages to 7 and 5 by weight. Adding cement in the form of a slurry was discouraged by the formation of small balls of cement.

A temporary wearing course of 0.2 gallon per square yard of 4-8 viscosity tar with an average penetration of $\frac{3}{8}$ inch was allowed to dry for 10 days, followed by an application of approximately 0.3 gallon per square yard of naphtha cut-back asphalt, and 10 pounds of sand. After rolling, the road was opened to traffic, and inspection during the spring showed the surfacing in good condition, with no failures ex-

cept a few cases of cracking and small pot-holes. Sections left unsurfaced showed the effect of traffic by shallow pot-holes and wear of the top crust.

In the opinion of those associated with the project, the sheepsfoot roller is better for obtaining compaction than tractors and loaded trucks. Densities probably would have been increased

had the moisture content of the mixtures been more accurately controlled at the time of compaction. Tests of cores indicated that mixing of the cement was fairly uniform throughout the samples. Average compressive strength at 86 days was 480 pounds per square inch, the low being 350 and the high, 581. Durability tests clearly indicated the benefit of adding cement to the raw soil.

Continuation of this method of soil stabilization applied to 2 miles of road during the summer of 1936, the Loris Experiment, was used as a test for specifications written for this type of work, as well as for improvement in equipment, and at the time the wearing course was applied in July, the base appeared to be in excellent condition.

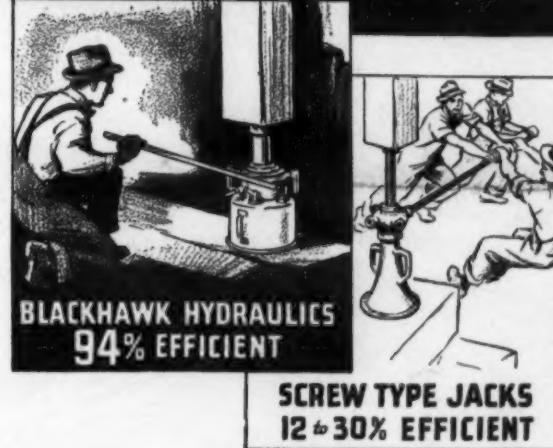
No attempt was made by Mr. Mills to draw definite conclusions. The action of weather and traffic will in time, Mr. Mills said, evaluate the worth of this method of stabilization. The present indication is, however, that treatment of soils with portland cement has appreciable merit and that it is possible and comparatively economical for many

light-traffic highways in South Carolina.

Some farmers say that they have little interest in the primary road system; what they want is farm-to-market roads. But careful traffic checks prove that farmers travel more miles to market over the 300,000 miles of main highways than they do over the 2,700,000 miles of unimproved or poorly-improved roads.



HYDRAULIC JACKS multiply MAN POWER

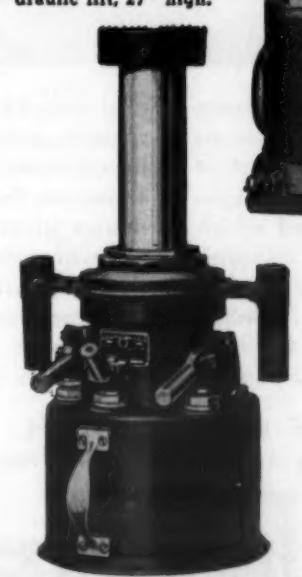


BLACKHAWK HYDRAULICS
94% EFFICIENT

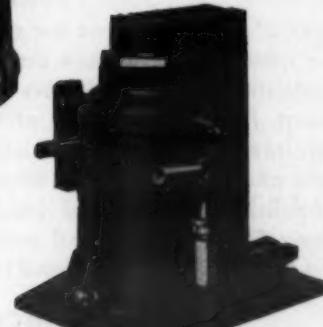
SCREW TYPE JACKS
12 to 30% EFFICIENT

Model K-18 Extra Heavy-Lift 75-ton Jack. High and low pressure pumps for speed and lifting. 18" low, 9" hydraulic lift, 27" high.

Model EA-11 Heavy-Lift 20-ton Jack. Compact, portable, safe, powerful, unbreakable. 11" low, 6 1/2" hydraulic lift, 17 1/2" high.



Model H-14 Floor Lift Jack. Lifts 12 tons from 1 1/4" off the floor—20 tons from top of ram. 14 1/4" low, 7 1/2" hydraulic lift, 22" high.



BLACKHAWK MFG. COMPANY
DEPT. GEN-4
MILWAUKEE, WISCONSIN

Exclusive Canadian Distributor
THE CANADIAN FAIRBANKS-MORSE CO., LIMITED
Branches in all Principal Cities



One man, with easy strokes on handle of K-18 pushed over this concrete wall, saving days of back-breaking hand methods.

BLACKHAWK HYDRAULIC JACKS

Tractor Front End Attachments

Write for Circular on types, sizes and prices
White Mfg. Co.,
ELKHART, INDIANA



Choosing the Personnel For Road Soils Studies

When selecting their men to carry on soils studies in Minnesota, civil engineering graduates are usually selected. At first men who had been out of school for two or three years were taken from the Construction Department and they worked from the Central Highway Laboratory.

The later men chosen for the department included some civil engineering graduates, a geologist and one man from an agricultural college who had specialized on soils. At present all new men are trained in the field with the older men as it is felt that the experience gained in the field is invaluable. In the future it is hoped that engineers from the Construction Department can be taken, trained definitely in soils and then put back into the Construction Department. This would spread the knowledge of soils throughout the entire department, the engineers would handle soils problems as a matter of routine and save the central organization for work on special problems.

Cost of Soil Surveys

The cost of soil surveys is such a variable item that it is difficult to set up any standard. A soils engineer with one assistant can average up to a mile a day under Minnesota conditions. The equipment is not extensive. A small amount of laboratory equipment is provided for each District, making provisions for sieve analyses, plasticity and density tests. It is not believed to be desirable as yet to extend the district laboratory work. Rather it is hoped that soil studies will be made as a project progresses and then an experienced engineer from the central office will review and pass on the work.

The amount of work which can be accomplished on a survey is a matter of terrain. On a 20.5-mile special survey in Minnesota made in cooperation with the U. S. Bureau of Public Roads, the soils survey was made after the location survey had been completed. Common labor was used for all of the boring, with one man in charge of three laborers. The engineer in charge identified the soil and took the notes. This work was done in a rolling country where there were clay loams and some gravel. Most of the boring was done with a 1½-inch auger to a depth of 6 feet with about 28 borings to the mile. In an 8-hour day about 16 borings were made, varying from 50 to 500 feet apart. At least nine samples of soils were taken for each mile at an average depth of 2 feet.

Preus, in charge of soil surveys in Minnesota, believes that it is best to educate the project engineer to use the soils as encountered on a project to the best advantage by disposing of unsuitable materials and placing the better materials in the upper portion of the grade. It is difficult to handle this situation and to prevent over-runs if provision is not made in the plans because payment for extra work is difficult to account for when final estimates are made. It is necessary to tell the contractor in advance what disposition is to be made of inferior material.

Soil Testing Instruments

A.S.T.M. Standard Designs
Special Designs as Used By
U.S. Bureau of Public Roads and
U.S. Bureau of Chemistry & Soils
Write for Catalog 37S-CE

Earth Exploration Meters

These devices cut earth exploration costs by
eliminating expensive core drilling.
Write for Bulletin 2053-CE

American Instrument Co., Inc.
1012 Georgia Ave., Silver Spring, Md.

O. L. Kipp, Construction Engineer, has pointed out that in the prairie country all excavation is handled in layers anyway. Instructions should be issued to the Project Engineer well in advance of the work. It has been found that, where specifications have been written to suit the material, the costs of exca-

vation have not been increased over the period of years during which this has been done.

B-E Distributor Reappointed

The Bucyrus-Erie Co., South Milwaukee, Wis., has announced the reappoint-

ment of the Connelly Machinery Co., 509 No. 27th St., Billings, Mont., as its distributor in the State of Montana, except the counties of Garfield, McCone and Valley, and for Teton, Park, Hot Springs, Washakie, Johnson, Campbell, Weston and Yellowstone Park Counties in Wyoming.

Owen Buckets

for Handling LOOSE Materials

for Excavating ALL Materials

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THE OWEN BUCKET CO.
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Branches: NEW YORK • PHILADELPHIA
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HERCULES DIESELS POWER PUMPS ON GOVERNMENT LOCK AND DAM PROJECT

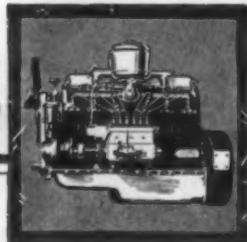


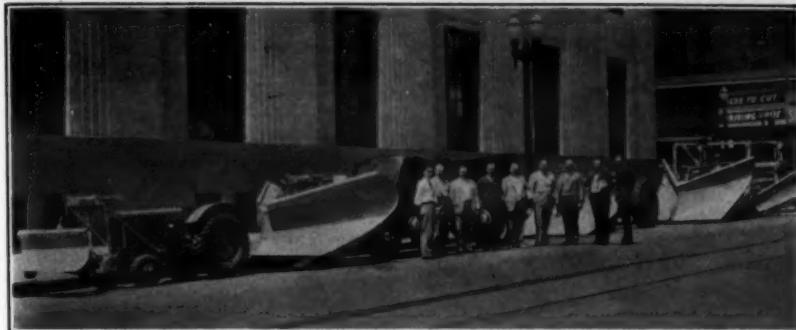
Six Moretrench pumps powered by Hercules "DJXC" Diesel Engines are speeding work on the new LaGrange Lock and Dam Project at Beardstown on the Illinois River. For high-speed, heavy-duty work of this kind which requires efficient, economical and dependable performance at all times, Hercules has established recognized leadership. Unlike many Diesels, designed primarily for only one type of application and limited by speed

and weight, the Hercules Diesel combines a wide speed range, minimum weight per horsepower, flexibility and clean combustion. These are the principal reasons for the preference given Hercules Diesels by manufacturers of commercial vehicles, power boats, industrial, agricultural and oil field equipment. The broad line of Hercules Engines and power units, both Gasoline and Diesel, includes a model to meet every power requirement.

HERCULES MOTORS CORPORATION, CANTON, OHIO
America's Foremost Engine Manufacturer • Power Plants from 4 to 200 H. P.

HERCULES ENGINES





Davenport-Besler Snow Removal Equipment Displayed at the Iowa County Officers' Convention in Davenport, Iowa, in June

Snow Removal Equipment Shown to County Officials

At the Iowa County Officers' Convention held in Davenport, Iowa, in June, the Davenport Besler Corp. of that city exhibited its full line of snow removal equipment, from which a number of orders were received. The equipment, shown in the illustration, included a small reversible blade plow mounted on an International Harvester I-12 tractor for sidewalk plowing and clearing intersections, a V-type plow mounted on an International CD-40 motor truck, and one of the larger snow plows with wings mounted on an International TD-40 tractor.

This company reports that both state and county highway departments in the middle west have become conscious of the fact that snow removal equipment must be ordered early to insure its availability for the first snow of the fall. With the thermometer hovering around 100, the Davenport Besler Corp. is very busy filling orders for snow plows for fall delivery.

Portable Crushing Plants For Secondary Road Work

Gruendler portable rock crushing and combined crushing and screening plants are particularly designed for secondary-road work. Various combinations of crushing and screening outfits are available, depending upon the particular requirements of the job.

The complete portable rock crushing plant consists of the latest-type Gruendler roller-bearing jaw crusher mounted on a low gooseneck or underslung steel truck frame, a power unit and folding bucket elevator with raising or lowering device for easy transportation, all so arranged that the unit will not tip over on rough or hilly roads. This unit, which is available in five crusher sizes, has capacities of from 75 to 125 tons of $2\frac{1}{2}$ to 2-inch material or 40 to 70 tons of 1 to $\frac{3}{4}$ -inch material per 10-hour day to 350 to 400 tons of $2\frac{1}{2}$ to 2-inch material and 200 to 220 tons of 1 to $\frac{3}{4}$ -inch material per 10-hour day.

The Gruendler straight-line crushing and screening plant is equipped with a 10 x 36 roller bearing jaw crusher, a 3 x 8-foot double-deck screen and 45-foot delivery conveyor, mounted on an all-cast-steel frame, and equipped with either bronze or roller bearings. This unit has a capacity of 60 to 100 cubic yards an hour.

When combined with the Gruendler stabilizing plant, which will uniformly

and thoroughly mix calcium chloride with clay or binder soil for road stabilization jobs, there results a complete low-cost road outfit. The stabilizer plant consists of a chloride feeder, clay or binder soil pulverizer, pug mixer, water pump and spray connection driven by an independent power unit, all compactly mounted on a portable truck.

The various crushing and screening plant combinations are described and illustrated in Bulletin No. 500 which may be secured upon request direct from the Gruendler Crusher & Pulverizer Co., 2917 No. Market St., St. Louis, Mo., by mentioning CONTRACTORS AND ENGINEERS MONTHLY.

Highway Construction Progress in India

A six-year program of road development, costing approximately 4,500,000 rupees (\$1,664,500), was adopted by the Bihar Road Board, Province of Bihar, India, in February. This program is divided into three classes: feeder roads, competitive roads, and other roads. In Bengal, important road projects which have either been generally improved or are under construction include 58 miles from Mymensingh-Tangail, to cost \$7,767,900; the North Bengal Highway, 98 miles long, to cost \$21,824,100; and the Chittagong-Ar-

racan Road, 84 miles, which is estimated to cost about \$12,576,600.

The Government of the United Provinces is pushing forward its program which began in 1936 and involves the expenditure of about 9,700,000 rupees (\$3,588,000) and a total of 1,128 miles to be constructed, according to a report from the U. S. Bureau of Foreign and Domestic Commerce.

HIGH CAPACITY 4" PUMP Self-Cleaning; high suction lift



FIG. 420



THE New INTERNATIONALS

Heavy-duty champion of the truck world at the top of his form—another of the new International Trucks, a powerful six-wheeler shown with armored dump body.

International Harvester presents to users of trucks the latest and finest products of its automotive plants—trucks at the peak of today's efficiency with a styling of exterior that is yours to judge. All the new Internationals are as NEW in engine and chassis, in structural refinement, in every vital detail, as they are NEW in streamlined distinction for the highway. All are ALL-TRUCK, and all are as modern as today's fine cars.

The International line offers a trim, streamlined unit for the Half-Ton field and a wide range of sizes for every type of load and hauling requirement. Here at the far end of the complete line is a truck for big tonnage, brute performance, and economy on an impressive scale—a finer product for the heavy-duty field to which International sells twice as many trucks as any other manufacturer.

See the new International Trucks. There is the right model and size awaiting your pleasure in the new array of trucks now on display at all International branch and dealer showrooms.

INTERNATIONAL HARVESTER COMPANY
(INCORPORATED)
606 S. Michigan Ave. Chicago, Illinois

Read what this driver writes:

International Harvester Company, Chicago, Ill.

As one of the drivers in the Payne fleet at Grand Coulee Dam, I was very much interested in your recent ad on the subject.

I am majoring in mechanical engineering at the University of Washington. I earn my expenses driving and repairing heavy trucks during vacations and other times. I have worked for practically all of the major trucking contractors in this part of the country, driving all the more popular brands of heavy dump trucks.

I am a most enthusiastic booster for the International six-wheeler. I drove the one belonging to Goodfellow Bros., Wenatchee, Wash., during its term of operation at Coulee Dam. Operating side by side with other dual-drives, the International was invariably picked for the toughest assignments. It became known without question as the toughest, most dependable, yet cheapest truck to operate per yard-mile of any truck on the project.

Yours respectfully,
Seattle, Wash. Harold T. Smith
February 13, 1937 4014 Brooklyn St.



This is the electric hammer that can be changed to an electric drill. Equipped with the new Wodack tool retainer. Every contractor who uses expansion bolts needs the "Do-All" hammer for drilling in concrete, brick and stone. Soon pays for itself. Model MJA drills $1\frac{1}{8}$ " in concrete and $5/16$ " in metal; MDH $1\frac{1}{8}$ " in concrete, $\frac{3}{8}$ " in metal. Ask for Bulletin and prices.

WODACK ELECTRIC TOOL CORPORATION
4633 W. Huron St., Chicago, Ill.

INTERNATIONAL TRUCKS

Night Work on Brick Job Because of Heat

Brick Laid by Day and Joint Filled; Asphalt Removed at Night on East St. Louis, Ill., Job

(Photo on page 48)

WE now have baseball games, football and tennis played under floodlights, and even some heavy excavation and concrete finishing in the construction game are done under artificial light. This has been due to insufficient time to do the work during the daylight hours. Quite the opposite was the cause of the Blackwell Corp.'s working under the witching light of the carbide and electric lights. It was just too darned hot for the squeegee coat, which was applied to fill the joints between the brick on Waverly Avenue, to harden sufficiently for the excess asphalt to be removed during daylight hours. So the crew went out around midnight when the temperature had dropped to around 90 and peeled the surplus readily.

This 4,000-foot state highway contract for a 36-foot brick pavement on Waverly Avenue, East St. Louis, Ill., including the 7-inch concrete base and 9-inch curb, was awarded to the Blackwell Corp., of that city.

Preparation of Mastic

The drying of the sand and mixing of the mastic was done at the general plant of the contractor about 2 miles from the job. The sand drier is quite a novel device and capable of handling all the sand required at a very rapid rate and with the minimum of cost. A 2-cylinder LeRoi gas engine runs a bucket elevator to which the cold damp sand is fed from a stockpile by one man. The sand is taken to the top of a 25-foot metal tower filled with adjustable baffle plates over which the sand cascades to the bottom of the tower and out through a chute to storage. Heat for drying the sand is furnished by a single fuel oil burner in a circular furnace at the base and the hot gases rise to the top of the 4-foot square tower and escape with the moisture from the sand.

The sand was moved to a nearby platform where a Koehring 27-E paver was used for mixing the sand in the proportion of 3,105 pounds of sand and 10.66 gallons of ACB No. 2 cut-back asphalt for the mastic. The mixture was stockpiled nearby for curing and then hauled out to the work as required for spreading.

Spreading the Mastic

The mastic was delivered in 5-ton loads to the concrete base and hand shoveled to approximate thickness. Then

two strike-offs were pulled over the base 10 feet apart to leave the proper thickness of mastic for laying the paving brick. The strike-offs were made of 2x12-inch lumber with cross pieces of the same material and well braced. The first strike-off was $\frac{1}{4}$ inch high, giving excess loose material for compaction by the 500-pound hand roller used longitudinally between the two strike-offs. The machines rode on three shoes of angles to give them the proper elevation above the grade. Five men were used to spread ahead of the first strike-off, one man for rolling between the two, and the strike-offs were pulled by a 5-ton White truck. The roller, weighing 500 pounds, was 3 feet in diameter and 3 feet wide. Strap iron edges on the



C. & E. M. Photo
A Well-Laid Job—Every Joint Filled and No Surplus Filler on the Surface

strike-offs saved wear on the cutting edges and on the second, which passed over compacted material, left a clean-cut grade for the laying of the brick.

Where the shoes of the second strike-

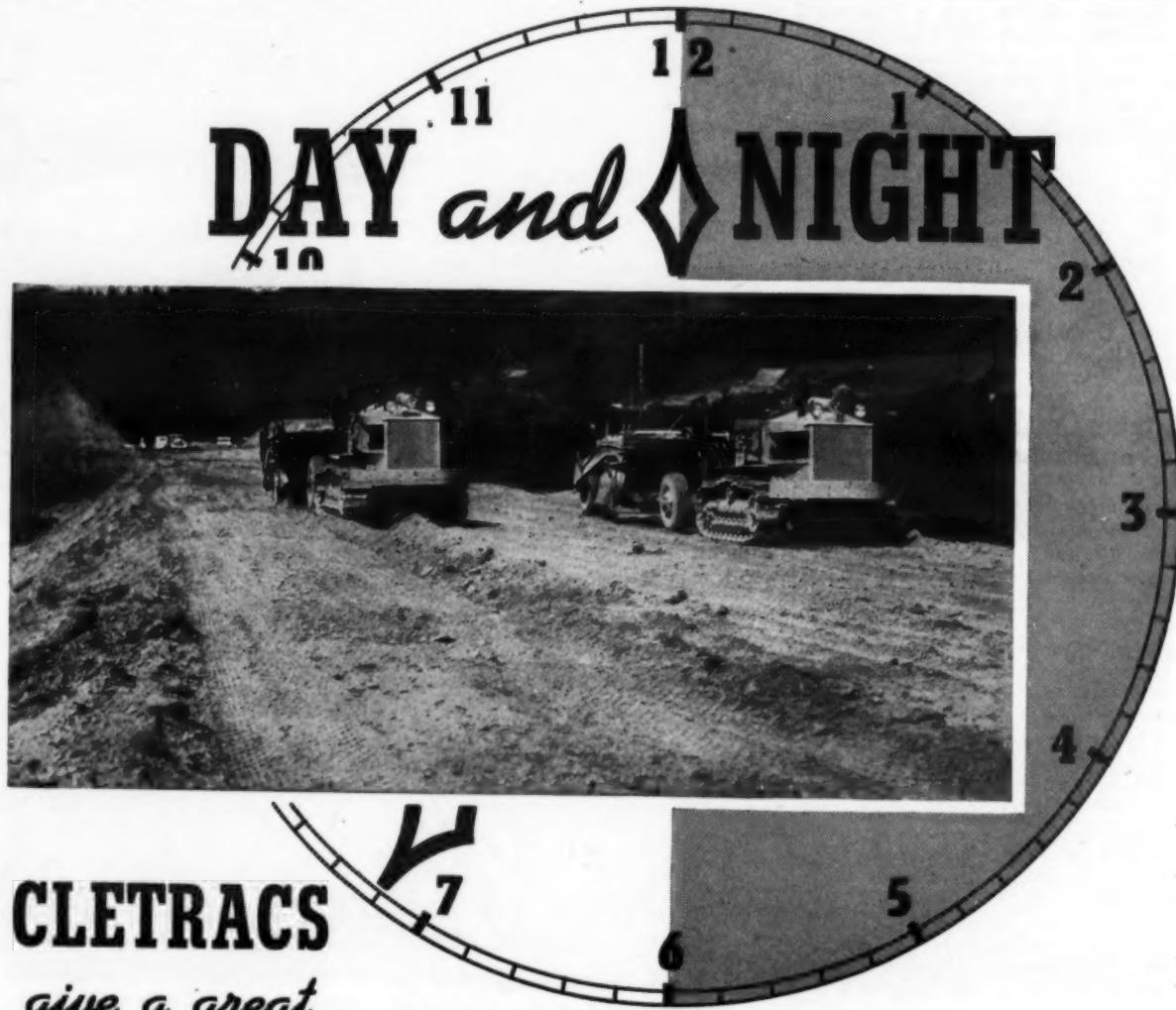
off ran, and along the gutter, a man used a triangular lute to smooth out any irregularities and shoveled the excess material back. He checked the surface with a 10-foot straight-edge and filled any depressions that might cause the brick to be low and hence require resetting, an expense unnecessary when the mastic is checked and spread properly. Along the edge the back man used a double square, looking much like a Z straightened out to right angles, for spreading the mastic to the exact elevation below the top of the curb.

Handling the Brick

With that uncanny knowledge that comes only from long experience, the brick was piled along the sidewalks and in the right number so that there were not more than a dozen bricks left per 100 feet of pavement when all culls and broken brick had been removed from the pavement and the bat man had filled in the ends of the rows.

When laying started, there were three

(Continued on page 25)



CLETRACS
give a great
account of
themselves...
ALL WAYS

THREE seven hour shifts—six days a week—week after week... that's performance which proves the stamina and power of Cletrac.

Thus performed two Model FD's and one Model 35 Cletrac on Oregon State Highways, finishing the job 45 days ahead of schedule. Trips averaged 1100 feet to the tune of 12 trips per hour. And when the job was done, it was found that the tractors had been down for repairs less than 45 hours in the hundreds and hundreds of hours worked—"Which," to quote operating officials, "is an outstanding record."

Cletracs can break performance records for you, too, and give a great account of themselves on the toughest earth moving jobs. They have the POWER, the SPEED and the MANEUVERABILITY needed for cost cutting dirt moving—anywhere.

THE CLEVELAND TRACTOR CO., CLEVELAND, OHIO

CLETRAC CRAWLER TRACTORS

The only tractors with controlled differential steering that keeps both tracks pulling at all times... on the turn as well as on the straightaway.





Spraying Outfit for Killing Weeds Along the Banks of Irrigation Canals and Ditches at Yuma, Ariz.

Killing Noxious Weeds

Wild cane, tule and other weeds growing along the banks of irrigation canals and ditches of the Yuma, Arizona, Project are destroyed by spraying with a cheap oil and then burning them later to kill the seeds. Hand sprayers, filled with Atlaside, are used in killing patches of morning glory, horse nettle, Johnson grass and other noxious types. About 100 pounds is used to 55 gallons of water, and spraying is repeated about once monthly from June to September. Thick sets of Johnson grass have been eradicated in this way.

The 600-gallon oil tanks, mounted on Chevrolet chassis, are equipped with coils inside, connected by hose with the radiator, to warm up the oil for spraying. To prevent loss of water by surging when the trucks cross rough ground, a thermostat on the radiator is set to close at a certain pressure. A Wood hydraulic pump furnishes spray pressure. The nozzles are attached to the ends of an 18-foot length of pipe by 25 to 50 feet of hose, as required. This pipe is arranged to slide 7 feet, either way, inside a section of larger pipe. The latter is supported at one end by an upright section of tubing, welded to the front of the tank. The rear end rests on a vertical pipe inserted in either of two 12-inch pipe sockets on the rear corners of the truck bed. This arrangement gives a maximum reach of 75 feet in either direction, if needed in crossing a ditch, etc.

The Yuma project is under the direction of the Bureau of Reclamation, R. C. E. Weber, Project Superintendent.

12-Cubic Yard Scraper Independently Powered

The A-W 12-cubic yard hydraulically-controlled scraper, which is made by the Austin-Western Road Machinery Co., Aurora, Ill., is equipped with a 32-hp motor which operates an hydraulic pump to provide a smooth, ample flow of power without fluctuation or interruption. Mounted just ahead of the motor are the hydraulic valves and magnetic control mechanism whereby the operator easily and quickly controls all adjustments from the tractor seat by using three small levers. A touch of his finger to one or the other of these levers

raises the front gate of the scraper for loading; drops the pan to dig at any depth; shuts the front gate, cutting through hard material; raises the pan to carrying position; or pushes out loads piled high for quick, uniform dumping. Because of the auxiliary motor on the scraper, no power is diverted from the tractor.

This A-W scraper is of all-welded special alloy steel construction, designed for rugged trouble-free service with low maintenance costs. The rugged front column is equipped with a heavy-duty cylinder for raising and lowering the pan. The pan floor is electric-welded, with a reinforced double bottom for maximum strength. The frame is arched to permit right-angle wheel turns when the pan is down or in loading position. The front gate in raised position provides ample unloading clearance; in closed position it is sufficiently high to maintain maximum loads. The sides of the pan extend forward, beyond the cutting bit, to prevent escape of material when loading. The rear push-



An Austin-Western 12-Yard Hydraulically Controlled Scraper Pulled by a Caterpillar RD8 Tractor

out door moves forward hydraulically to eject the load forcibly and spread the material.

This scraper can dig against a vertical bank and can dump material at the edge of a fill, according to the manufacturer, because the rear wheels track inside the cutting bit. Full universal ball and socket connection between the

king post and front axle provides flexibility. The reversible bits and pan sides are hard-surfaced for maximum wear.

Complete details on this A-W scraper may be found in a new bulletin which the Austin-Western Road Machinery Co., Aurora, Ill., will be glad to send on request.



CP-52 Sinker Drills do it again!

Above, nearing completion, the Manhattan shaft of the Manhattan-Queens Midtown Tunnel now building in New York City. The shaft, 60 ft. wide by 120 ft. long, is shown at contract depth of 115 feet . . . sunk through New York City's stubborn bedrock . . . with tunnel drifts being opened . . . days ahead of schedule.

To Triest Construction Co., contractors, full credit for a difficult engineering job skillfully handled. From CP-52 Sinker Drills, used exclusively on the job, another convincing demonstration of their sturdiness, their speed, their complete dependability when the going is tough!

Write our nearest branch office for complete details.

Above: Typical view of CP-52 Drills in action on the difficult drive of a 60'x120' shaft to a depth of 115 ft. through stubborn Manhattan bedrock. Below: CP-52 Drills are here shown opening one of four tunnel drifts about 95 ft. below surface.



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R-6-37

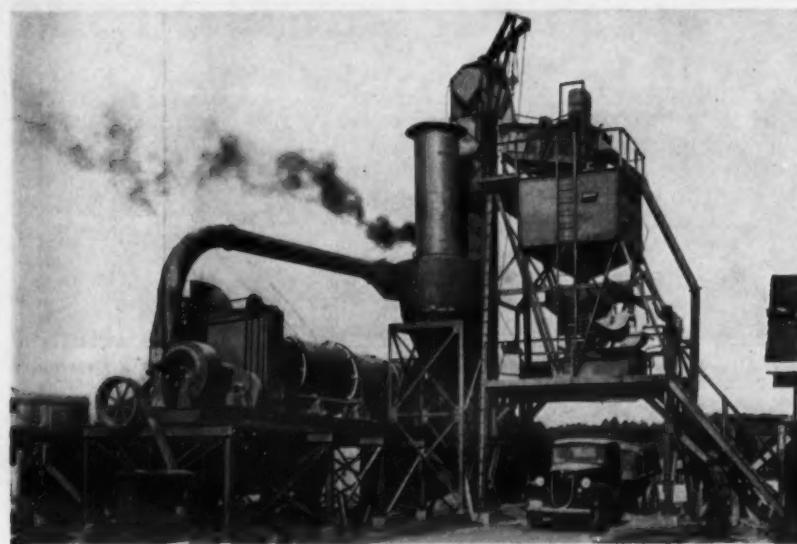
CUMMER ASPHALT PLANTS

Two-Fire Dryer-Cooler
For Either Hot or Cold Mix
No Silos Required

LARGE CAPACITY PORTABLE PLANTS
WITH 1-TON, 1 1/2-TON OR 2-TON MIXER

Electrical or Mechanical Time Lock
to Meet Any State Specifications

The F. D. Cummer & Son Co.
17th and Euclid CLEVELAND, OHIO



The New Hetherington & Berner Portable Oil-Mix Plant

New Portable Plant For Bituminous Mixing

A new folding-type portable bituminous mixing plant, particularly designed for secondary road work, has recently been announced by Hetherington & Berner, Inc., Indianapolis, Ind. The plant, which is adapted to standard flat bed truck or trailer hauling, consists of two units, the dryer unit and the screening and mixing unit.

The dryer unit, with a 60-inch diameter by 24-foot drum, is loaded on a standard truck and trailer and hauled to location. A steel sub-frame, straddling the truck, is attached, allowing the truck and trailer to pull away. The mixer platform bin, 2,000-pound mixer and mixer drive and section of hinged A-frame, are transported as one unit on a steel skid frame. The skid frame is used as a gantry for erecting the remaining plant units. The hot material elevator, completely assembled with jib crane, swings into place on a special hinged base. A hand hoist, permanently mounted on the

mixer platform, is a regular part of the plant equipment and can be operated by one man. The weigh box is mounted by means of the hoist and jib crane built integral with the elevator. The bin is then swung into position by the same method. The vibrating screen unit, mounted complete with chutes and power unit on a steel frame, is raised and set in position with the jib crane which is also used to set the dust collector. The bucket and scales, stairway and handrails are then attached and the mixing tower is ready for operation. The entire plant can be assembled by three or four men in one or two days.

Features of this plant are the use of SKF bearings throughout, a fully-enclosed vibrating screen, a steam-jacketed steam-operated steel mixer, large-size combustion chamber and dust collector. Separate power units are provided on the dryer, mixer and screen, with gasoline, diesel or electric power as desired.

This new portable bituminous mixing plant is completely described and illustrated in Bulletin T-250 which may be secured from Hetherington & Berner.

(Advertisement)

Cone Crusher Output Increased 25% With V-Belt Drive

HIGH above the Columbia River and more than a hundred miles north of Spokane, the Spokane Portland Cement Company had quite a problem on a cone crusher in their Bossberg, Washington quarry.

A long flat belt drove this crusher. Dust

Gates Vulco Ropes Run in Heavy Dust Where Flat Belt Slipped and Jumped

in the crusher house was very bad—and the belt would slip and jump every time



Gates Vulco Ropes now drive this cone crusher. Installed because a long flat belt slipped and jumped at every overload, the new drive has increased output 25%.

World's Road Mileage Up 51 Per Cent in Last 8 Years

During the past 8 years of intensive highway construction and modernization, more than 3,000,000 miles of roads have been added to the world's highway facilities. Highways serving the world's motor transportation requirements now total more than 9,900,000 miles, an increase of 51 per cent for the last 8-year period. These figures, together with other interesting information on significant phases in the development of highways throughout the world, are contained in "World Highway Progress," a comprehensive report issued recently by the Highways Committee of the Automobile Manufacturers Association.

According to this report, the influence of the United States upon the highway construction programs of every other nation is unmistakably profound. The most interesting points of similarity between highway development in the United States and that found in other countries are chiefly matters of technical procedure. Everywhere, it is reported, highway engineers are following road-building practices in this country and nowhere are projects being undertaken which have not already been executed in a similar fashion here.

Copies of this report "World Highway Progress" are available to state and county highway engineers, government officials and road builders by writing direct to the Automobile Manufacturers Assn., 366 Madison Ave., New York.

NEW CMC MIXERS

MORE
FOR
THE
MONEY



CMC 7s and 10s End Discharge Models. New—compact—fast. The advantages of a speedy trailer with four wheel stability.



CMC 5s-7s-10s Two Wheelers. The fastest moving—fastest working one and two bag Mixers ever developed.

THE BIGGEST MIXER VALUES OF THE YEAR!

Every machine right up to the minute in every detail—every one a product of long experience in building dependable Mixers.

Get the facts on CMC Mixers all sizes—Wonder Tilters—Dumpover Pneumatic Tired Carts (See Illustration) Hoists, Pumps, Saw Rigs, Wheelbarrows.

CONSTRUCTION MACHINERY CO., Waterloo, Iowa

(Advertisement)



"High above the Columbia River . . ." The crusher house, from which this view was taken, discharges crushed rock down a vertical shaft to ore cars more than 100 feet underground. The cars can be seen emerging from the tunnel onto a trestle, far below.

the crusher feed came a little too fast. Whenever this happened, the crusher



Mr. Sandoz

plugged tight—and had to be shoveled out by hand.

This condition was so bad that Mr. Sandoz, Quarry Superintendent, tried put-

ting a man beside the crusher to constantly check the feed and the drive. Even this did not keep the belt from jumping.

Then the Gates engineer called, and Mr. Sandoz laid the problem before him. Together they installed a band of Gates Vulco Ropes to handle the 100 h.p. load.

Mr. Sandoz tells us he has not been able to plug the crusher since he installed the V-Belt Drive. But he is still more enthusiastic about the fact that with belt slip eliminated, the output of the crusher is now 9 or 10 loads an hour higher—a 25% improvement!

Ten-Mile Paving Contract Planned to Reach Borrow

W. W. Magee Planned Job In Southeastern Minnesota To Prevent Tangle in Final Operations

TO most contractors shouldering is a task that comes along at the end of a paving contract and just delays the final estimate that much. W. W. Magee, contractor of St. Paul, Minn., in planning the operation of his 10-mile concrete paving contract north of Wabasha, Minn., on U. S. 61 along the shore of the Mississippi River, looked ahead and laid the pavement to make the borrow pit for shoulder material more accessible.

The batching plant was located 2½ miles north of Wabasha and paving was started May 29, 1936 from the north end of the contract and continued south to a point ½ mile south of the plant. The mixer was then moved to the south end of the job and the slab completed, running north. The reason for the extra ½ mile of paving beyond the batching plant was that it enabled the contractor to gain access to the top-soil borrow pit for the shoulder material and to run his trucks out over the pavement as soon as the last 2-mile stretch had been laid. Thus the shouldering went faster and the final estimate came home sooner than if the usual method of paving to the batching plant from both ends had been used.

Preparing the Rough Grade

There was 4,000 yards of lift material per mile of grade to be placed on the previously prepared grade and for this work the contractor used a Bucyrus-Erie gas-air dragline loading to his own fleet of trucks. The same machine was used for ditch and shoulder work. A Caterpillar Super Special grader pulled by a Caterpillar RD6 diesel tractor spread the lift material ahead of the fine-grading and form-setting operations. The new pavement was over an old black-top pavement which had been allowed to get into a rather poor condition. The lift ranged from 2 to 14 inches to bring the grade to the new elevation.

The grade for the 9.7-9-inch slab was cut ahead with a Warco grader drifting the dirt back onto the grade. The thickened edge runs for a distance of 4 feet from the edge and then both the concrete and the subgrade have a parabolic curve which gives a uniform thickness of the slab of 7 inches across the center 12 feet of a standard 20-foot pavement.

Two form setters and six laborers, which included the men lining forms ahead of the paver, handled the Blaw-Knox 9-inch forms. They were followed by five men on fine grade with a scratch template and one man just ahead of the paver trimming along the forms. Two men hand-tamped the forms and one oiled the forms by spraying with a portable pressure sprayer. The grade was rolled to firmness with a 7-ton Huber gas-powered machine.

Preparing the Batches

The batching plant was located about ¼ mile off the right-of-way on a rail-

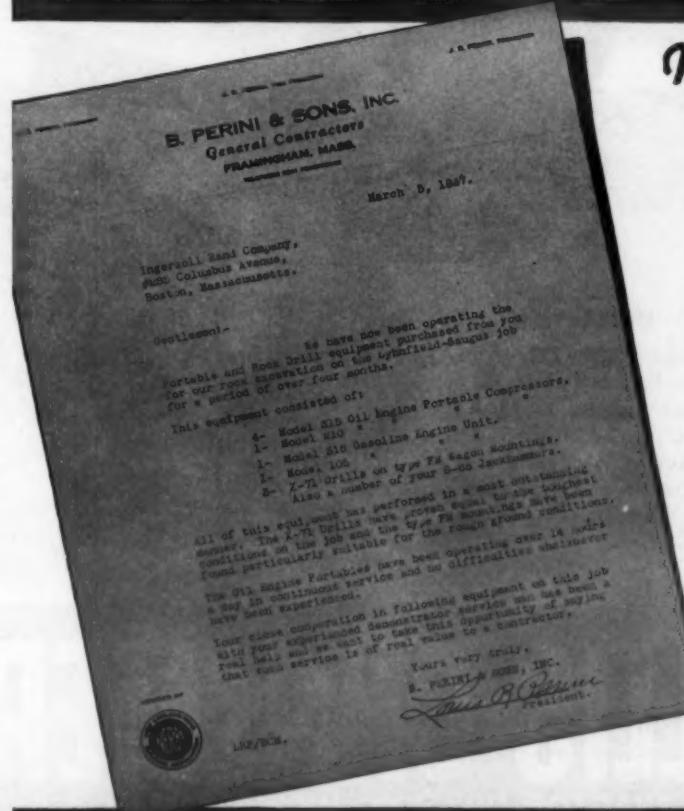
road siding adjacent to the commercial gravel plant which produced the aggregate for the job. The contractor's office and the various accessory buildings such as the oil house and machine shop were at the same location. The Central States Construction Co. operated the gravel plant and filled the cars during the day which were hauled at night by the contractor's own Caterpillar Sixty-Five gas tractor up the slope to the plant. Both sand and gravel were unloaded from the gondola cars by an Osgood crane with a 1½-yard Williams clamshell bucket to the Blaw-Knox 80-ton batching plant. The unit batches were weighed out by the batch man as follows: 1,491 pounds of sand, 2,356 pounds of gravel and 576 pounds of bulk cement. The fleet of 8 to 22 batch trucks hauling two batches each alternated backing under and driving directly into the batching pit. The contractor operated his own eight Hug trucks and hired the balance as needed. The continued lack of rain during the first part of July made the dust a nuisance and dangerous to the operation



C. & E. M. Photo
Assembling 10-Foot Sections of Steel for Transverse Joints

of the trucks as well as damaging to the machinery. The contractor considered watering the area around the batching plant as well as at the cement platform but the job would have been continuous, so he used oil instead and thus laid the dust quickly and permanently. The section around the cement platform required about three times as much oil per square yard as the remainder of the

(Continued on page 36)



Mr. Perini says:

1. ".....this equipment has performed in a most outstanding manner."
2. ".....the type FM mountings have been found particularly suitable for rough ground conditions."
3. "The portables have been operating over 14 hours a day continuous service....."
4. "Your close cooperation.....has been a real help and is.....of real value to a contractor."

We are grateful to B. Perini & Sons, one of New England's largest contracting firms, for their hearty endorsement.

If you have not already done so it will pay you to investigate I-R Two-stage, Air-Cooled Portable Compressors and associated equipment. Phone, wire or write our nearest branch office for form 1604F and detail information on any of our products listed below.

AIR COMPRESSORS JACKBITS
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**Concrete VIBRATORS
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Write for Circular on types, sizes and prices.

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Atlanta Birmingham Chicago Duluth Los Angeles Pittsburgh Seattle
Boston Cleveland Dallas Newark New York Pittsburgh St. Louis
Buffalo Denver Houston Knoxville Newark Philadelphia Salt Lake City Tulsa
Butte Detroit

Costs and Equipment For Mont. Maintenance

(Continued from page 2)

ly small mileage of gravel surfaced and unsurfaced roads is confined to the lesser used routes upon the 7 per cent system. However, it is our plan to have all of the mileage under maintenance by the state bituminous-treated within the next year or two. Evidence of the progress being made in this direction is the 608 miles of original oiling completed by the State Highway Commission forces during the last summer and fall. This oiling was in addition to a considerable mileage which was oiled under contract with Federal Aid during the same period.

Montana has about 175,000 registered motor vehicles which travel over the state road system, in addition to the vehicles which bring a large number of tourists into the state each year. Montana's scenic attractions are such that an increasingly large number of tourists are visiting the state each season and the State Highway Commission, through its recently organized Traffic Department, with its nine Port of Entry Stations, furnishes an information service to the out-of-state visitor which is meeting with general appreciation.

Equipment Shops

For the overhauling, storage and repair of the maintenance equipment used by the Department, there are eleven shops with adequate facilities maintained at strategic points over the state, in addition to a central shop at Helena, where the more difficult repair work is handled. Large tanks at all of the eleven shops are used for the storage of gasoline and road oil, which is purchased in car-load lots.

Maintenance Equipment

The following maintenance equipment is owned and operated by the Montana Highway Department. A total of 180 snow plows, exclusive of snow wings, is available for snow removal. Practically all sections of the state highway system are kept free from snow and in good passable condition for travel during the entire winter period.

Passenger cars	25
Trucks	
Light (1-ton and under)	69
1½-Ton (2 with four wheel drive)	217
2-Ton (15 with four wheel drive)	34
3½-Ton (four wheel drive)	34
5-Ton (four wheel drive)	12
6 to 7½-Ton (four wheel drive)	11
Graders	
Team patrol (8-foot)	73
Pull type (8-foot)	18
Pull type (10-foot)	34
Pull type (12-foot)	14
Motor Patrols	
With 10 to 12-foot moldboard	117
Road Maintainers	
Pull type, multiple blades	10
Spring scrapers, under-body	2
Road Discs and Scarifiers	
Pull type	9
Scarifier attachments for motor patrols and graders	66
Snow Plows	
Sno-gos, auger-type, with auxiliary power units	5
Rotoplow	1
Rotary type, with auxiliary power plant	9
V-type	57
One-way type	108
Snow wings	54
Tractors	
Crawler, Model 20	13
Crawler, Model 30	8
Crawler, Model 40	9
Road Brooms	
Self-propelled	7
Pull type	10
Road Rollers	
Self-propelled (6-ton)	5
Pull type	8
Road Oil Heaters	
Portable power spray units (400-gallon)	18
Two-wheel tar pots (100-gallon)	32
Road Oil Distributors	
Pressure distributor (600-gallon)	4
Pressure distributor (1,200-gallon)	4
Booster tanks (1,200-gallon)	4
Booster tanks complete with semi-trailer	3
Portable Boilers and Retorts	
Steam boilers	12
Retorts	9
Pug Mills	
Portable (3/8-cubic yard capacity)	1
Portable (1/2-cubic yard capacity)	13
Gravel Loaders	
24-inch belt conveyors, with power units	6
Traffic Line Markers	
Pressure type, truck mountings	2
Shovels	
½-cubic yard, gasoline-powered	1
¾-cubic yard, gasoline-powered	1
½-cubic yard, gasoline-powered	2
Master loaders, adaptable to 30 tractor	6
Draglines	
½-cubic yard bucket complete with power unit	1
½-cubic yard bucket with boom, shovel attachment	1
Gravel Crushers	
Crusher units complete with power plants and bins	3



The Type of Laminated Guard Rails Used on Montana State Highways

Sand Spreaders	27
Truck mountings	
Compressors	

Portable type	2
Truck Scales	6
Portable type	18
Power Mowers	6
Truck mountings	14
House Trailers	14
Trailers	2
35-ton	12
10-ton	12

Universal Crane Company Merged with Thew Shovel

The Universal Crane Co., a separate corporation and a subsidiary of the Thew Shovel Co., was merged with the Thew Shovel Co. in June, and will become the Universal Crane Division. The $\frac{3}{8}$ to $\frac{3}{4}$ -cubic yard units as well as the truck-mounted cranes previously manufactured by the Universal Crane Co. will now be known as Universal-Lorain

units. The Thew products, including 1 to 2-yard crawler shovels, cranes, draglines, clamshells, backdiggers and skimmers, will continue to be known as Thew-Lorain units.

New Hose Catalog

A new 64-page catalog, in loose-leaf form and pocket size, covering the complete line of braided and molded hose made by the Electric Hose & Rubber Co., Wilmington, Dela., has just been published. This catalog has been designed for the convenience of the user, the data and information being indexed according to use as well as kind of hose. Copies may be secured gratis direct from the manufacturer by mentioning this magazine.

TRACTOR WEIGHT SAVED IS EXTRA

MODEL "L-0"

These "L-0" Oil Tractors are hauling slate on a road job in Maryland. A-C BALANCE means tractor weight saved, quicker pick-up, faster hauling and lower costs.

ALLIS-CHALMERS
TRACTOR DIVISION—MILWAUKEE, U. S. A.

Controlled
OIL TRACTOR
—TIMED RIGHT TO FIRE THE

New 2½-Yard Shovel Arc-Welded Throughout

A new high-speed fully convertible 2½-yard shovel, P & H Model 955, has just been announced by the Harnischfeger Corp., 4419 W. National Ave., Milwaukee, Wis. This new machine is arc-welded throughout, reducing weight in the upper revolving deck, lower car body, crawler side cranes and the digging attachment. This reduction in weight makes possible faster digging with less wear and tear on the machinery and at the same time provides stronger unit construction to withstand the strain of excavator work, according to the manufacturer.

Features of the Model 955 are heavy-duty roller bearings on the swing clutch-

es, hoist drum, crowd drum and other parts; a double safety boom hoist; split second clutches; six lubricated hook rollers; a live-roller circle for faster swing; all-welded shovel boom; and a lighter aluminum boom for dragline work. Power is furnished by an 8-cylinder 185-hp Fairbanks-Morse diesel engine. A special tandem-drum arrangement provides parallel cable pull to and over the center line of the machine to eliminate excessive cable wear. Split sprocket lagging is provided for quick changeover for shovel service.

As a dragline, the 955 is designed for large daily yardage over wide clean-up areas. Equipped with long crawlers with 36-inch wide shoes or wider if necessary, provision has also been made for an easy change to longer crawlers to re-



The New P & H Model 955 2½-Yard Shovel

duce ground pressure on exceptionally soggy ground.

Complete information on this new excavator is contained in a new bulletin on the Model 955 which may be secured direct from the manufacturer by mentioning this magazine.

Heat Required Work At Night on Brick Job

(Continued from page 20)

handlers on each side placing the brick on sloping roller conveyors from which, also using tongs, two men to a side picked off the brick and stacked them for the layers. The two layers moved back and forth rapidly, placing the brick in position. In order that the lines would be straight and tight a sledge man went across each line of brick with a 4x4 swung from a wire and sledged against the rows, using the timber as a straight-edge and buffer.

Filling the Joints

Immediately behind the layers, the inspector marked all bricks for culling and turning where necessary, also the low and high bricks or areas, and a crew of two men culling and turning took care of the yellow spots. One man broomed the section to be poured so that all chips and other trash were removed. Two men handled the bats. One man devoted his time to the rings indicating the high and low brick and the roller man ran the Buffalo-Springfield gas tandem roller back and forth to bed the brick uniformly in the mastic.

Before the filler was poured over the surface of the brick, it was sprayed with a solution of starch, calcium chloride and water from a container of 20 gallons capacity, using a small Fairbanks-Morse engine and air compressor delivering 125 pounds pressure.

The filler was heated to the proper temperature in three Littleford heating kettles, one a new fuel-oil burner and the other two wood burners converted by the contractor to coal-oil burners. The filler was drawn into coal scuttles filled to within 4 inches of the top and with the top nearly covered with a welded cover to prevent insofar as possible the slopping of the hot filler against any workman. The asphalt gang consisted of four carriers, three peelers, one man picking up the rolls of asphalt, a fireman, a solution man, and the foreman. An extra man devoted his time to cleaning off spots that were left by the peelers.

The organization did not work all at the same time on this job as the intense heat of the first weeks of July, 1936, when this work was at its height, prevented the excess filler material on the top of the brick hardening sufficiently to permit the peelers with their cut-back snow shovels to get the material to roll off as it should. This meant that they had to come back in the midnight hours and do their turn. To furnish light the contractor had four National Carbide flares and a string of three 500-watt electric lights. By arrangement with property owners along the street these were plugged in on the house circuit and the lights supported on tripods where needed the most.

The morning following the peeling one man went back and poured the low joints with a cone pouring pot.

This contract was in charge of T. T. Moore as Superintendent. J. F. Kilpatrick, Engineer for the City of East St. Louis, was Resident Engineer in charge.

New Bulletin on Core Drills

New bulletin No. 2213 describes the Calyx shaft core drill and contains illustrations of shafts and cores which have been obtained with drills of this type in exploratory work. Shafts, usually 36 inches in diameter, are drilled in dam foundation sites and other locations where it is necessary to have accurate information regarding the formations.

Other uses of these drills are also described in this bulletin, copies of which may be secured from the Ingersoll-Rand Co., 11 Broadway, New York City.

Payload GAINED

YOUR tractor moves two kinds of weight—dead load and payload. Each costs money to move, but only payload pays dividends. Every pound of dead load eliminated from the tractor means an extra pound of payload hauled.

Excess tractor weight is reduced through proper balance between power, speed and weight. Allis-Chalmers pioneered the BALANCED tractor—it was the Model "35" (now the "K") and the Model "L" which completely changed the trend of tractor design and performance. These and other A-C Models have led the way to a new kind of higher-speed, lower-cost dirt moving. These tractors speed up your job because they are designed to give maximum performance in the higher speeds—the speeds at which you do more than 90 per cent of your dirt-moving work.

Get the complete story on what A-C BALANCE means—in reduced investment, wider usefulness, higher speeds, quicker pick-up, better hill climbing, fuel savings, less maintenance—and lower bidding. Tractor weight saved is extra payload GAINED!

MODEL "K-O"

Because of their BALANCE, A-C Tractors have never been equalled for bulldozing. This "K-O" Oil Tractor is feeding a gravel plant at Garfield, Utah.



MODEL "S-O"

Time saved to and from the fill; lower cost per yard. That's what A-C BALANCE means in this "S-O" Oil Tractor, owned by Isabella County, Mich.



*edognition
ACTORS
FIRE THE RIGHT TIME*



C. & E. M. Photo
Week-Old Rock Asphalt Resurfacing as
Annealed by Traffic

Rock Asphalt Used For Resurfacing

(Continued from page 1)

Spreading with a Drag

In an 8-hour day the contractor was able to cover 2,500 feet of the 20-foot pavement with a layer of the rock asphalt that was $\frac{1}{2}$ inch thick when compacted by traffic. The first operation was to apply a tack coat of rapid-cure cut-back at the rate of about 0.1 gallon per square yard which was allowed to become quite dry before the rock asphalt was windrowed on the surface.

A fleet of three 5-ton and two 3-ton trucks hauled the material from the siding at Smithfield to the job and windrowed the material along the road in about the proper amount for the 8-foot strip about $\frac{5}{8}$ -inch thick. The drag used for spreading is built of 3 x 10-inch lumber with 2 x 3-inch angles on the front of the four cross members which are carried $\frac{5}{8}$ inch above the surface of the ground so that a small amount of the asphalt was "lost" or permitted to run out over the edge to be used to seal the edges of the paving. This was done by an adjustable $2\frac{1}{2}$ -inch x 3-inch shoe at the side along the side runners by which the entire drag can be raised the proper amount that experience has shown will permit the right amount of material to be "lost." The drag is tied to rigidity with $\frac{1}{2}$ -inch tie rods across in front of each cross member. The cross members are at right angles to the center line of the road and there are no diagonal drag members.

When a sufficient length of windrow had been spread and a truck of sufficient weight and power to pull the drag had come up, all was ready to move ahead and spread. Nine men and a foreman made up the crew which was a well-drilled team with every man as active as could be during a forward movement. All four of the cross pieces were kept filled with the material from start to finish on one forward movement of the drag. A man at the rear with a rake steadied the drag and kept the end from swinging out from the pavement. Two men kept the rear cross member filled with the material piled in front of the third cross member. The material naturally accumulated in front of the first cross member most rapidly as the drag moved forward over the windrow. Two men riding the drag on the front shoveled excess material to the second cross member while a single man shoveled from the second to in front of the third cross piece. One man at the front watched the amount of material in the windrow and kept the drag from moving too far to one side. The remaining pair of men worked from front to rear shoveling as needed to keep each of the cross members filled with a sufficient amount of material so that it would roll ahead of the member.

Traffic was kept clear of the roadway until the spreading drag had finished its work. Then the roadway was opened to traffic for seven to ten days to knead the

surface into a consolidated plane. This was followed by the leveling drag which was similar to the spreading or surfacing drag except that it was heavier and loaded with lumber and men so that it would cut off the high spots and fill the low spots shown up by traffic over the road. This leveling drag was used only the material sheared most easily under the material sheared most easily under the leveling drag. The leveling drag was run over the surface until it was certain that all irregularities had been planed off and the low spots filled. Then the roadway was opened to traffic as a finished unit. Traffic was still controlled for a short space of time by flagmen who distributed the traffic over the entire surface of the road and did not permit fast speeds.

On another job of a similar nature the trucks which brought in the material were not used for pulling the drag. This was done by an industrial tractor with rubber-tired wheels and a 300-foot cable so that the tractor could be run on the shoulder entirely out of the way of the

trucks which could deliver their loads as rapidly as possible and permit a longer stretch of roadway to be resurfaced in a single working day. On the Logan-Smithfield job the center strip left after the two 8-foot strips had been laid was spread by blocking the tailgates of the trucks and controlling the amount of material in the drag to the quantity that was just needed to fill the 4-foot center strip. The Sunnyside rock asphalt used

has an asphalt content of between 9 and 11 per cent.

F. B. Haynes was Resident Engineer for the Utah State Road Commission on this contract of Olof Nelson. W. M. Edman was Inspector in charge.

Argentina is spending 100,000,000 pesos this year on highway projects, completing 22,237 miles of roads, 300,000 culverts and 231 bridges.



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Mowers, Motor Graders and
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Above: Two 7 yd. Continental Wagon Scrapers on an Illinois highway job.

Lower illustration: Two 7 yd. Crawler Mounted Continental Wagon Scrapers pulled by an "A.C." Model "SO" Tractor carrying 8 yard loads of tough, gummy clay, and leveling off previously dumped loads.

Lighter in Weight — Yet more Cutting Ability!

Continental Wagon Scrapers weigh less per yard of actual hauling capacity, yet they dig deeper and load faster because their entire weight is concentrated on the narrow cutting blade. In Continental-designed two-wheeled Wagon Scrapers there is nothing to hinder the cutting effort — nothing to stand in the way of the blade doing its utmost work — nothing to interfere with fast, clean dumping.

Continental Wagon Scrapers will dig and load anything the tractor will pull through. They "hog out" tough, gummy clay with less effort, less power. Sticky soil slides up the smooth body interior of the scraper without hindrance, and is unloaded faster because it is actually dumped out—not dropped!

Continents give you everything: they back dump like a truck, eliminating the necessity of bulldozing; because of their two-wheel traction, they turn fast; they are used for spreading, grading and filling; ruggedly constructed, they outwork and outlast any dirt-moving equipment made.

Use Continents on your next dirt-moving job and get in more loads per day. Made in 4, 5, 7 and 10 yard capacities for use with all sizes of crawler tractors; they are available mounted on rubber-tired wheels in all sizes, or with crawler tracks on the 5, 7 and 10 yard sizes. Continents are easy to operate — and require no particular operating experience.

Sold and serviced by Allis-Chalmers dealers everywhere!

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Tractor Equipment Division
Railroad Avenue
East Chicago, Indiana



CONTINENTAL WAGON SCRAPERS

Better Rock Removal With Less Explosive

C. W. Caletti & Company Had California Contract for Improving Southern Approach to Yosemite

(Photo on page 48)

WHEN a contractor uses less explosive to move more rock, it's news. As always, some brains mixed with any material increases production. A closer spacing of drill holes and shallower drilling produced far better results on the C. W. Caletti & Co. contract for 8.0 miles of grading and structures from Kelshaw Corners to Coarsegold, in Madera County, Calif., on the road to the southern entrance to the Yosemite National Park.

Cheaper Rock Removal

The change of methods of handling the rock drilling on a large cut early in the contract made a considerable saving over the cost of removing the first portion of the rock. The rock cut had a 5-foot overburden of earth that was skinned off with a power shovel. Then the drilling of the hard rock was started with a Cleveland wagon drill, using 3½-inch Crusca detachable bits with 1½-inch steel and with a spacing of the holes 16 feet apart and 3 feet from the slope line. Three rows of holes were drilled and sprung twice, first with seven sticks of 40 per cent dynamite and then 25 sticks of the same strength, and then blown out and loaded with 50 pounds of 40 per cent bag powder in the bottom. This combination did not break up the rock sufficiently to permit economical handling by the power shovel. A change to a spacing of 9 feet with no springing of the holes and loading with 40 per cent bag powder up the barrel to within 3 feet of the top resulted in the production of one yard of proper size rock for each one-half pound of explosive used.

This 47,000-yard cut of rock was about 1,000 feet long and a maximum of 35 feet deep. Air for the drills was furnished by a 310-foot Gardner-Denver air-cooled compressor. Jackhammer work was done with four Ingersoll-Rand

and four Gardner-Denver hammers, using Timken detachable bits which were sharpened three times with a Quickway grinder. Most of the material from this large cut went into a sidehill fill which was managed so as to give the best possible results with the minimum of extra work for the contractor.

The contractor used two 1½-yard Northwest power shovels with a Wisconsin 4-cylinder engine in one and a 6-cylinder St. Paul power unit in the other. These shovels each loaded out 100 yards of the shattered rock per hour or 1,400 yards per day. The work was run with three 7-hour shifts on the drills, two 7-hour shifts on the shovel in rock and one 8-hour shift on the shovel in earth. The maximum haul for the fleet of four to eight 5-yard Autocars was



C. & E. M. Photo
Two of a Quartette of 12-Yard Carryalls Working in a 400-Foot Cut of Decomposed Granite

5,600 feet from this cut with a 500-foot

free haul. The contract called for 256,000 station-yards of overhaul from this cut alone. For the longest hauls an additional hauling fleet of six 7-yard Brockway trucks was used.

Placing Fill

The State Highway Department prefers the kneading action of the pneumatic truck tires to the use even of a sheepfoot roller when there is a considerable proportion of rock in the fill. On this work there was an estimated shrinkage of 20 per cent in the earth and zero shrinkage of the decomposed granite which was found in large proportion in the cut.

In order to insure the stability of the fill which was of considerable depth and on a side hill, the contractor sent in his Caterpillar Sixty and LeTourneau bulldozer to cut a switchback around the bottom of the fill to permit the trucks to dump some of the heavier rock on the toe to weight it against slides. The use of the sheepfoot roller was concentrated

(Continued on page 34)

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Worthington 315 cubic foot two-stage Portable Compressor operating a Worthington Rock Master Drill on an important road job

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THE JAEGER MACHINE CO.
701 Dublin Ave., Columbus, Ohio

Snow Fence

(Continued from page 2)

barriers, first because of its immediate effectiveness and secondly because of the wide right-of-ways necessary for planting trees and shrubs.

Types of Snow Fence

Of the various types of artificial snow fence, horizontal slat type, vertical slat type, solid type, and emergency fence of burlap, old bags, brush, etc., the vertical slat type is the most widely used, thirty-one states reporting 90 to 100 per cent of their snow fence as that type. Colorado, Indiana, Iowa, Maine, Massachusetts, Nebraska, New Hampshire, New Jersey, New Mexico, North Dakota, Ohio, Oklahoma, Pennsylvania, Rhode Island, Virginia, Washington and Wisconsin use nothing else, while most of the other thirty states have about 95 per cent of the vertical slat type, the remainder being the horizontal slat type. In Oklahoma, according to a report from H. C. Stallings, Assistant Maintenance Engineer, the flexible vertical slat snow fence has been found most practical, having proved efficient and effective. In the eastern third of the state, natural protection is depended upon and snow fence is used only in the north central and western sections.

Connecticut and Maryland, on the other hand, prefer the horizontal slat type, 95 and 90 per cent, respectively, of their snow fence being of that type with the remainder of the vertical slat type.

Wyoming reports a total of 592,274 feet of snow fence, of which 34,650 feet is permanent, 154,591 feet portable, 6,310 feet of metal vane, 50,611 feet of portable panel, 321,153 feet of picket, 1,150 feet of wire mesh and 23,809 feet of miscellaneous types.

Few of the states use any appreciable amount of the solid type of snow fence. Utah has about 5 miles, while South Dakota has 1 per cent metal snow fence, 1/2 per cent wood panel and 1/2 per cent permanent installation. Through the sparsely settled plateau regions of eastern Oregon, the land values are such that it is more economical to purchase right-of-way and install a permanent board fence, since the cost of erection and dismantling as well as the wear and tear on the portable slat type fence is far greater than the purchase price of the right-of-way. J. N. Bishop, Oregon Maintenance Engineer, has found that the board fence is more effective than the vertical slat type. They have not increased their footage of that type for several years and most of the vertical type, about 10,000 linear feet, which they have was constructed by state forces doing their own weaving.

Nevada, the only state reporting on the subject of "emergency" snow fence, has about 2 miles of brush snow fence,

made of sage brush and barbed wire, which proves very satisfactory for controlling drifts.

Natural Snow Barriers

Of the thirty-five states in which the snowfall is heavy enough to warrant any type of snow fence, only thirteen have any planted snow barriers. This ranges from 0.4 mile in New Hampshire to 50 miles in Michigan. Pennsylvania has 25 miles of natural snow barriers and reports that, although these require time to grow and become effective, and locations where they can be used are limited, such barriers as are of sufficient size have proved very effective. North Dakota and Wisconsin have 8 miles each, West Virginia 16 miles, Wyoming 10 miles, Colorado 3,000 feet, Connecticut 2,654 feet, Illinois 12,000 feet and South Dakota 5,900 feet. In Kansas about 2 per cent of the snow fence is planted. West Virginia has found natural snow barriers equally as effective as artificial snow fence. They encounter some difficulty in getting property owners to permit the state to erect artificial

snow fence on their property without paying rent, which has never been done. Delaware has about 1/2-mile of planted snow barrier.

New Jersey has done no planting specifically to create natural snow barriers but in many cases its roadside development projects have formed drift prevention conditions. From 20 to 25 miles are so protected. Virginia, on the other hand, does not favor planting, believing that it takes good land out of cultivation. Oklahoma finds natural snow barriers impractical in the area where most of the snow protection is required as this is their most arid region during the summer months and therefore not conducive to a good growth of shrubs, hedges or trees.

Installation and Storage

In practically all cases, snow fence is erected in October or November by the regular maintenance crews. In a few states, additional men are taken on at that time to assist in this work. The distance from the roadway at which the snow fence is placed varies from a

maximum of 300 feet to a minimum of 30 feet, the average distance being approximately 75 to 100 feet.

Scott P. Hart, Montana's Maintenance Engineer, added to his report an interesting note on their method of installation. Due to the high winds which prevail in Montana, and the broad expanses over which they sweep, it is necessary at many points to erect two sections of 4-foot snow fence, one above the other.

(Continued on next page)

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Snow Fence

(Continued from preceding page)

This type of fence, known locally as a "double decker," is supported by wooden posts properly guyed and placed at from 8 to 10-foot intervals. In some instances it has been found that two or more lines of snow fence, placed from 80 to 150 feet apart, are needed to trap the snow before it reaches the highway.

Pennsylvania places its snow fence, all of the vertical slat type, on the north and west sides of the highway, these being the directions from which the greater number of storms originate and the fence is very effective in the prevention of drifts when the storms come from the prevailing wind directions. When the very infrequent heavy east or southern storms occur, usually only at intervals of several years, the Department has some real trouble. For a number of years past, the Department has gradually increased the amount of snow fence purchased so that at the present time all heavy drift locations on the windward sides of the main highway system of approximately 13,000 miles and a considerable mileage of the secondary system of approximately 28,000 miles are protected. Their progressive system of increased purchases will be continued until all such locations are so protected.

About 95 per cent of the snow fence used in Utah is the lath type, 30 inches high, wired to pipe posts made from second-hand boiler tubes. These posts are 8 feet 10 inches in length, driven into the ground, leaving 6 feet above the surface. The fence then can be raised as the drift forms and covers the lath. In many cases, they have built up drifts 10 to 12 feet high and the drifts assist in preventing further drifting.

In Oklahoma the flexible slat-type fence has been found to be easily installed and removed. Since this fence is used primarily in the part of the state known as the Wheat Belt, the temporary installation is never objected to by property owners as the planting is completed before the fence is erected and the fence is removed before harvesting begins. In fact, property owners welcome the installations in their fields as they get the advantage of more moisture from winter snows than they would otherwise.

Snow fence is generally dismantled in April or May and in most cases is stored in the maintenance shops, district maintenance stations or garages, although in a few cases it is stacked on private property or along the right-of-way. In Montana a considerable part of the snow fence in uncultivated areas is left in place the year round. Ohio makes use of county garage sheds to store about 85 per cent of its fence, the remainder being stored elsewhere.

Summary

In Alabama, Arkansas, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Texas and Florida there is no need for snow fence. In New York State, snow removal is delegated to the counties, the State paying 50 per cent, but not exceeding \$100 a mile, of the total cost of expenditures on the state highway system. Therefore, the installation and maintenance of snow fence does not come under the jurisdiction of the Division of Highways. In Idaho, this work is taken care of by the District Maintenance Offices and the State Department of Public Works was unable to furnish any data on the subject.

Information on the amount of snow fence used, its installation and the

amount purchased annually, practically all of which is purchased in the summer or early fall, for the remaining thirty-five states appears in the table on page 2, with explanatory notes below.

Admixture for Concrete Increases Placeability

Pozzolith, an admixture for concrete which it is claimed makes it possible to reduce the amount of water necessary for the mix and at the same time increases the placeability of the concrete, is described in a new 20-page booklet recently issued by the Master Builders Co., 7016 Euclid Ave., Cleveland, Ohio. In addition to a description of Pozzolith and its effect on concrete, the booklet also contains a number of interesting job photographs.

Copies of this booklet which is called "Less Water Yet More Placeability" may be secured by interested contractors and engineers direct from the Master Builders Co., by mentioning this magazine.

STERLING BALANCED WHEELBARROWS

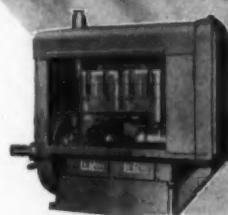
GREATER PART OF LOAD BALANCED OVER WHEEL. LESS THAN 20% ON ARMS.



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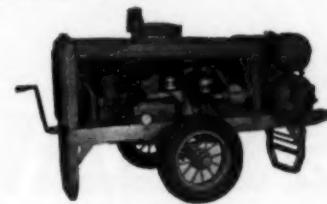
STERLING WHEELBARROW CO., MILWAUKEE, WIS.

LEROI



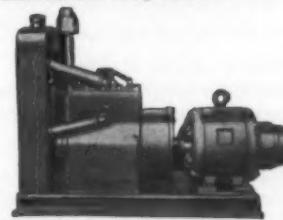
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LE ROI COMPANY, MILWAUKEE, WIS.

Constructing Sewer Tunnel in New York

(Continued from page 1)

to check the contact plane between the limestone and the chlorite. Borings Nos. 6 and 7, 455 feet 2 inches and 459 feet respectively, were driven from the Manhattan end of the tunnel on steeper slopes than No. 2 to establish the point of contact between the limestone and gneiss at a point about 20 feet above the proposed sub-tunnel. These two borings were spread so that they would be 20 feet north and south of the tunnel bore at the points of contact between the two rock formations.

Borings Nos. 8 and 9 were driven for short distances upwards from the Manhattan Tunnel to check the character of the rock at the location of the chlorite. Borings 10 and 11, the latter 487 feet long, were made vertically downward from the Wards Island shore. No. 10 hole collapsed and the drill stuck but No. 11 was driven so that it established a contact with the limestone. The No. 10 boring went into a badly decomposed schist which flows more slowly than the chlorite but continues its flow.

No. 12 boring, 230 feet long, was made from the Wards Island side when the rock began to get soft. It could not be driven farther, and the casing and drill were lost because the fine material caved. The amount of material that came in through the hole where the 2½-inch casing had been driven was equivalent to a hole 2½ feet in diameter.

No. 13 boring was driven on the Wards Island side for a distance of 524 feet to check the satisfactory elevation for the sub-tunnel. It indicated that the sub-tunnel could be safely located in limestone at the proposed 500-foot depth.

No. 14 boring was driven for 72 feet in advance of the heading along the roof of the sub-tunnel at an elevation of about 10 feet above the roof of the tunnel and was driven from the shaft.

A total of 4,600 feet of borings was made to check the stability of the rock structure for the sub-tunnel.

Around April 29 and from then until the tunnel was holed through on May 7, the contractor was ordered to put holes from 14 to 20 feet long ahead at the top of the tunnel while it was approaching the contact plane between the schist and the limestone and then after May 3, these holes were continued because the limestone became softer and slightly salty to the taste. These holes were plugged when loaded for firing.

Initial Shaft Construction

Work was started on the Manhattan shaft on March 25, 1936 and Elev. —300 was reached on June 6, 1936. This shaft was designed to be 8 feet 6 inches in diameter after concrete lining but the contractor excavated to 9 feet 6 inches so that a standard cage could be used in the tunnel.

The top of the Manhattan shaft is to be a grit chamber for the removal of

mineral matter from the sewage so that there will be little danger of this inverted siphon filling with deposits after it is used to convey sewage to the Wards Island sewage treatment plant. The grit chamber is 40 feet deep and from this point the contractor started the 9-foot 6-inch diameter shaft in gneiss. Drilling was done with 2½-inch down to 1½-inch detachable bits in the shaft, the holes being 6 feet deep. There were 14 rim holes, 10 first relief holes and 8 cut-out holes in the center bored to form a cone. Three or four Ingersoll-Rand jackhammers were used in the shaft and air was brought to the hammers by a 4-inch pipe and a manifold for attaching the four hose lines. Sixty per cent du Pont dynamite was used for blasting and the shots were fired direct from the 110-volt line.

Mucking was all done by hand, loading to a 1-yard cylindrical bucket swung by a gas-powered crane at the surface. In the shafts there were three 8-hour shifts working 7½ hours with ½ hour out for "eats" on each shift. There

were always two rounds fired each day and sometimes three. The sequence in the lower shaft was the same as in the upper except for the method of removing the spoil.

Upper Tunnel and Lower Shaft

Following the completion of the Manhattan shaft, work on the tunnel at the 300-foot depth was started June 6, 1936. The tunnel is 8 feet 6 inches in diameter

and was driven 944 feet before work was stopped and the contractor ordered to drive the second shaft to the 500-foot depth. The lower shaft is 8 feet 6 inches in diameter and was started a distance of 870 feet from the upper shaft. Work began on February 19, 1937 and the shaft was completed to a depth of 210 feet on April 7, 1937. On this same day, work was started on the sub-tunnel.

(Continued on page 32)

ROAD BUILDING EQUIPMENT

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- Rapid and easy adjustment of width.
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MANUFACTURING CORPORATION
100 Southwark Street, Philadelphia, Pa.



An Adams Diesel Motor Grader and V-Type Snow Plow Bucking Snow Drifts in Minnesota Last April After One of the Season's Heaviest Snowfalls

Record Snowfall in Minn. Set in 3 Months of 1937

Heavy winter snow, which set a 50-year precipitation record in some parts of Minnesota, cost the State Highway Department \$1,215,514 for snow removal in the first three months of 1937, or \$188,679 more to keep the roads open than in the same period of 1936, according to the Maintenance Division report.

Snowfall reached a depth of 112½ inches at Brainerd, while Detroit Lakes reported 104½ inches and Morris had 82. Heaviest drifting occurred in and near Morris and Willmar, while Marshall and Windom were also deep in the drift country. Snowfall ranged from 60 to 70 inches in most parts of the state.

Total snow removal expense in 1936 on state highways was \$1,406,816 from January through December. For 1937, the expenditures include the \$1,215,514 for snow removal in January, February and March, plus \$274,000 for the erection and dismantling of some 6,000,000 feet of snow fence. Of this approximately \$24,000 was for new fence. In addition, there must be added the cost of keeping the highways open in October, November and December of this year.

Although the cost of highway maintenance for the nearly 11,500 miles of road increased, no state highway was closed for more than a few days this year and no main trunk route was closed for more than 24 hours, except in isolated cases. Approximately 400 units of snow removal equipment were used. Counties were assisted in some cases on secondary roads where state equipment was available and over-taxed county plows were unable to do the job.

Baker Mfg. Co. Vice Pres. Dies

J. G. Miller, Vice President and Sales Manager of the Baker Mfg. Co., of Springfield, Ill., died recently after a two months' illness. Mr. Miller, who

was 55 years old, had been associated with the Baker Mfg. Co. since its incorporation in 1908, having been one of its organizers and its first secretary. For many years he was in charge of the company's purchasing and production and for the past fifteen years was in charge of sales.

Bureau of Public Roads Gives Soils Study Course

Soil testing has become of such importance in highway construction, and the demand for instruction in the work so great, that the U. S. Bureau of Public Roads has found it necessary to give to highway engineers in the public service a scheduled course in the study of soils. Many engineers already have received instruction in methods developed in the Bureau's Research Laboratory.

The new knowledge of soils and how they act under different weather conditions is important in the construction of all types of roads. The character of soil on which a road surface is placed is often as important as the type of surface itself. The soil expert is able to indicate the general character of surface needed to meet general soil conditions and to point out those places where poor soils must be removed or given special treatment.

A knowledge of soils and soil testing

is particularly necessary in constructing low-cost secondary roads. There can be no single standard method of constructing soil, sand-clay and gravel surfaces because of the variation in local materials. The engineer must adapt his methods to the materials at hand to obtain the best results. This can now be done with accuracy if the materials are tested in a soils laboratory and the knowledge gained by painstaking research is applied.

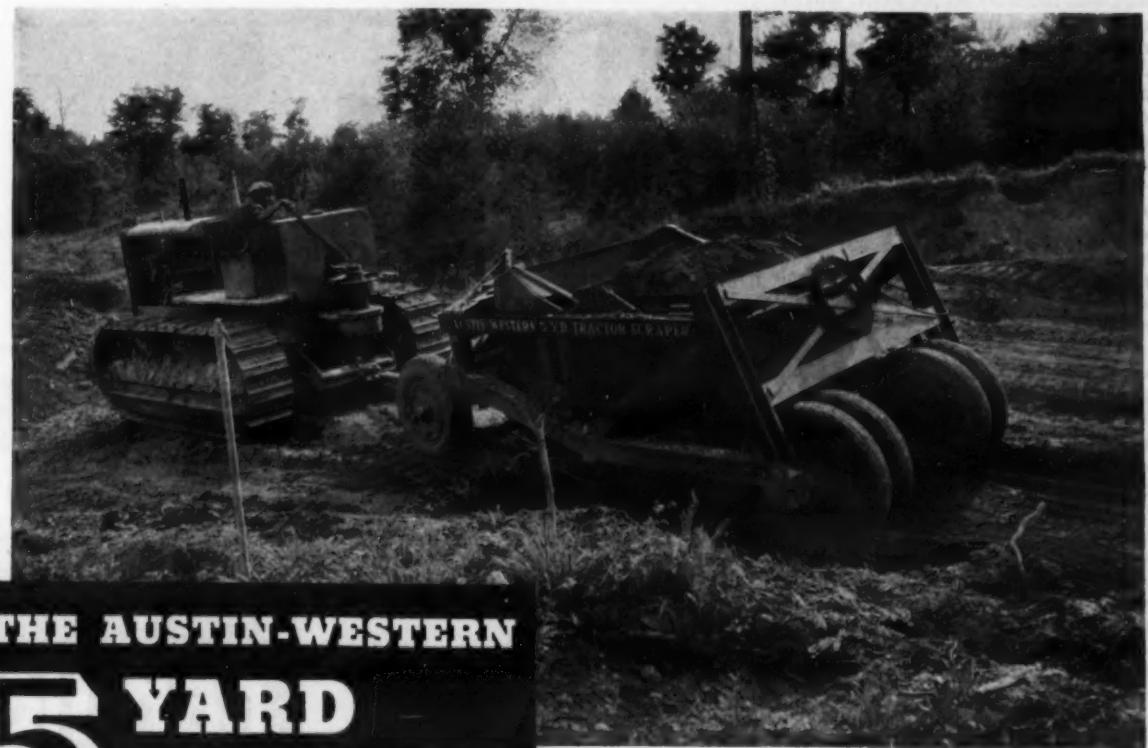
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*Built to load more dirt per
Tractor Horse Power*

Successful contractors and leading engineers tell us this scraper gives them more dirt moving per dollar invested, and loads more dirt per tractor horsepower than any other scraper of the same capacity.

When loading the dirt moves in easily, for the rear wheels track inside the cut and the pan floor is level with the ground. Under favorable soil conditions, a 35 to 40 H. P. tractor is sufficient, yet the electric welded frame has ample strength to insure capacity loads in tough going, behind a 50 to 60 H. P. tractor.

Rough ground, gumbo or sand are all in

the day's work for this scraper. With four wheels properly spaced, plenty of pan clearance, and a three point frame suspension, it will travel wherever the tractor takes it—180° turns are easy.

Dumping and spreading the load is accomplished at top speed by the 5-Yard Tractor Scraper—a single cable and winch controls every operation from the tractor, and the scraper can dump the whole load at once or spread it to any depth up to 9 inches.

Operating advantages such as these explain why A-W Tractor Scrapers are regularly leading the field in performance records.

Send for Newest Bulletin No. 1680, giving complete operating construction details.

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Austin-Western

Constructing Sewer Tunnel in New York

(Continued from page 30)

from the Manhattan side.

An electric hoist was installed in the dead end of the upper tunnel for handling the cars of muck from the sub-tunnel. Two 18-inch I-beams were concreted into the rock above the shaft to support two longitudinal beams which carried the sheaves for the 1 1/4-inch steel hoisting cable. A single-drum Clyde hoist with both automatic and hand brakes and driven by a 60-hp General Electric alternating current motor raised the cars. The 30-inch-gage industrial track for the Koppel tunnel cars was laid on an upgrade over the top of the shaft and for about two car lengths beyond. Empties were run up the ramp by the Milwaukee electric locomotive which hauled them in the tunnel. A section of track over the shaft was lifted by an air hoist, and the empty lowered or a full car raised from the bottom of the shaft by slings. After the trap had been lowered, the full car was spotted on the track and permitted to roll downgrade toward the locomotive, being snubbed by a rod through the wheels.

At the top of the upper shaft, three full stories above street level, a Clyde hoist equipped with both automatic and hand brakes and driven by a 100-hp G-E motor handled the 1 1/4-inch shaft cable. The cages were raised to one story above ground level for passengers and to the second story level for unloading the muck cars. This hoist operated at 270 feet per minute and the cable was well marked with paint and with a pointer to indicate the intermediate stops and the limiting stops at the top and bottom of the shaft. On the second-story platform a turntable was installed together with storage tracks and the dump into the bin for loading trucks. The muck cars were all end-dumped and were tipped by a U-shaped hitch which fitted over the car couplings and then a second U which caught the hook on the end gate. This permitted tipping the entire car.

Tunnel Driving

Drilling for the tunnel was done to 8-foot depths with 25 holes per round made up of 6 cut holes, 2 center busters, 7 relief holes and 10 line holes. On the bench the drilling was varied, sometimes using lifters and at other times vertical jackhammer holes. The bench and the tunnel were shot at the same time, the lifters providing a screen to check flying rock from the face. The tunnel was driven in three shifts, using three drillers on each shift. Regular drill steel, rather than detachable bits, was used in the drilling of the tunnel. Each shift averaged 4 1/2 hours of drilling and there were usually three shots in each 24 hours. The drilling crews at the Manhattan face averaged 112 feet of tunnel per 6-day week, and 6 pounds of 60 per cent du Pont dynamite were used per cubic yard of rock removed.

In the upper tunnel a Conway shovel was used while in the lower tunnel the

mucking was done with a Hoar shovel.

Auxiliary Equipment

A 8-inch steel air line for ventilation was carried along the left side of the tunnel while on the right were the 4-inch line carrying air at 115 pounds, the 2 1/2-inch water line for the drills, and the 4-inch discharge from the pumps. A 4-inch rubber air hose was used for the last 100 feet with a manifold for the air lines to reach the drills. Ten insulated wires were carried at the top of the left side of the tunnel for lighting service and the hoist. The lights were spaced 25 to 30 feet apart and were all 50-watt factory-type incandescent lamps, covered with wire cages for the 200-foot section nearest the face where they were continually being moved at the time of blasts.

Double track for a distance of 150 feet in the tunnel at the bottom of the upper shaft permitted one man to handle the muck cars satisfactorily and allowed some storage. In a heel at the base of the upper shaft an Allis-Chal-

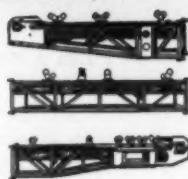
mers 4-inch centrifugal pump and motor and a 4-inch Deming pump were installed for drainage. A 4-inch Cameron air pump at the bottom of the lower shaft provided for the drainage there. The tunnels were unusually dry, most of the water being found in the

upper shaft.

A 500-cfm Sullivan air compressor driven by a 100-hp G-E motor, a 550-cfm Chicago Pneumatic compressor driven by a 125-hp G-E motor, and for the last two weeks of drilling an I-R

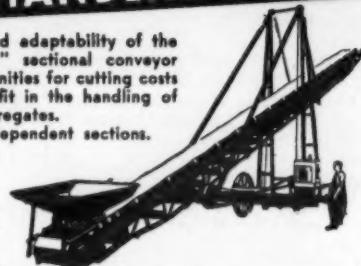
(Continued on next page)

NEW WAYS TO CUT MATERIALS HANDLING COSTS



The flexibility and adaptability of the Porta "Model 347" sectional conveyor offers wide opportunities for cutting costs and increasing profit in the handling of concrete and aggregates.

Made up of independent sections. Can be used on wheel truck, caster mounting or on supports as permanent or semi-per-



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Easily disassembled, easily transported, easily reassembled. Our catalog describes our complete line of portable, sectional, and permanent conveyors designed to suit every contractor's requirement.

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Every day this reliable wire rope, preformed the Williamsport way, is handling more work on more and more operations. All because the operators want ropes that last longer, do more work. Purple Strand "Form-Set" is exceptionally able to handle work more economically because it's built to wear better.

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STRAIGHTEDGE

Either Steel or Aluminum

For Checking Concrete Surface
Two useable edges—one sharp-cornered and squared for scraping; the other rounded for fine-point straightedging.

ASK YOUR DEALER

L & M Manufacturing Co.
(Division of Mosaic Forge Co.)
10302 BEECH RD., CLEVELAND, OHIO

N.Y. Sewer Tunnel Through Solid Rock

(Continued from preceding page)

300-cfm portable, supplied the high-pressure air for drilling at 115 pounds pressure at the compressors. Ventilating air was supplied by a Roots-Connersville blower at the top of the shaft adjacent to the compressors and in the same structure was the charging machine for the locomotive batteries with the wires being carried into the tunnel for charging the batteries below ground.

The Manhattan Tunnel is built on a 0.2 per cent grade in the upper tunnel sloping toward Wards Island and in the lower tunnel the slope is 20 feet in 700 feet towards the Island. The uptake shafts on Wards Island are 1 foot less in diameter than the down shafts in Manhattan. This is to maintain an increased velocity to carry suspended matter in sewage. The total length of tunnel is 3,390 feet and of shafts 1,030 feet. There is a 12-inch minimum thickness of concrete in the shaft walls and the same for the tunnel.

Labor Organization

The George H. Flinn Corp. employed the following labor organization for the Manhattan tunneling operations: three drillers, three helpers, two motor men, two hoisting engineers, one shovel engineer, one electrician, one pipe man, one pump man, two top men handling muck cars, one compressor engineer, one storehouse keeper, one time keeper, one watchman who cleaned up, one magazine keeper, one powder man, five muckers, three laborers, one drill foreman, one mucking boss and one superintendent.

Personnel

The Manhattan Tunnel is part of Contract No. 3 of the Wards Island Sewage Treatment Project of the Department of Sanitation, New York City, William F. Carey, Commissioner; Walter D. Binger, Deputy Commissioner in Charge of Engineering; Richard H. Gould, Chief Engineer, Bureau of Sewage Disposal and Intercepting Sewers; Herbert M. Hale, Construction Engineer, Wards Island Project; W. R. Barry, Deputy Construction Engineer and Bernard Morrison, Assistant Engineer for the Manhattan shaft and tunnel operations. A. Hjort is Chief Engineer and Frank Lee, General Superintendent, for the George H. Flinn Corp. of New York City, contractor for the Manhattan shafts and tunnel.

Sheets Becomes President Of Portland Cement Assn.

Announcement has been made of the election of Frank T. Sheets as President of the Portland Cement Association, to become effective September 1, succeeding Edward J. Mehren who recently resigned. Mr. Sheets for the past four years has been consulting engineer and director of development for the Association. Previous to that, he was associated with the Illinois Highway Department for 23 years, for 12 of which he was Superintendent of Highways and Chief Engineer.

Mr. Sheets has served as President of the American Association of State Highway Officials, of the Mississippi Valley Highway Conference, and of the Central Illinois Section of the American Society of Civil Engineers. He was an official delegate from the United States Government to the Pan-American Highway Congress at Rio de Janeiro in 1929.

His experience in the highway field covers practically all phases of highway financing, design, construction, maintenance and administration. During the past few years he has directed the ad-

ministrative and technical policies of the Highways Bureau of the Association and the industrial research to develop new and improved uses of portland cement and concrete, in addition to performing his duties as consulting engineer.

Uses of Rock Asphalt

Specifications and designs for the many uses of Kentucky rock asphalt in road construction and maintenance are contained in a new 30-page booklet recently issued by the Kentucky Rock Asphalt Institute, 312 South Fourth Ave., Louisville, Ky. It is intended to serve as a general guide and instruction book for the proper use of this material and in addition contains detailed information on the features of Kentucky sandstone rock asphalt and a number of photographs.

Copies of this booklet may be secured gratis by interested contractors, state and county highway engineers direct from the Kentucky Rock Asphalt Institute by mentioning this magazine.



A. F. GIBSON
Los Angeles
You can square off to the best
digging angle in a hurry with
this P&H live boom.

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EMBODYING 29 YEARS' EXPERIENCE

ECONOMICAL • EFFICIENT • STURDY
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● You'll find many a job where this P&H feature will save you time and money. You can raise or lower the boom to any desired angle—quickly, without changing length of the crowding chain. The one-piece shipper shaft bearing is unit-welded with the boom to eliminate misalignment of pinions and excessive rack wear. So dependable is this design, there is seldom a chain replacement on one of the new P&H Pacemakers. For information on the size you need, address the Harnischfeger Corporation, 4419 West National Ave., Milwaukee, Wis.



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EXCAVATORS • ELECTRIC CRANES • ARC WELDERS

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HOISTS • WELDING ELECTRODES • MOTORS

Less Explosives Move More Rock on Calif. Job

(Continued from page 27)

principally on the earth fill where the traffic was at a minimum.

Hitting Water in Rock

The contractor's men might have thought they were the Moses of the New World when on a section of road about a mile from the big rock cut they hit water consistently at about 2 feet in the wagon drill holes. Strung along the road for the smaller rock cuts and outcrops a 260-foot Schramm and two 120-foot Ingersoll-Rand compressors handled the jackhammers. Two Cletrac 80 tractors with LeTourneau rippers were used to break up the decomposed rock such as the well-known "D.G." or decomposed granite that tightens up in the fills and is a contractor's delight.

For moving the earth on a series of cuts as well as in the large cut to be described in the next paragraphs a new 14-yard Carryall scraper and a 12-yard as well as two 8-yard Carryalls were used. The contractor kept two arc-welding outfits on the job so that he was able to get to any piece of equipment that had a breakdown and repair it promptly. A 250-ampere Schramm welder and another mounted on a Fordson tractor and developing 200-amperes were available at all times.

17,000 Yards from 400-Foot Cut

Working to a balance in both directions the quartette of Carryall scrapers was used effectively in a top soil and decomposed granite cut 40 feet deep and from which 17,000 cubic yards of material was taken in a distance of 400 feet. These scrapers were hauled by two Cletrac 80 diesel tractors and two

Cletrac 40 diesel tractors, with another gas-powered Cletrac 30 pulling the LeTourneau sheepfoot roller on the fill. A crew of six men was kept busy hand trimming the earth slopes on a true 1 to 1 slope. The rock slopes were also 1 to 1 and the embankments 1½ to 1.

Quantities

The contract required the removal of 296,000 cubic yards of unclassified excavation, 6,500 cubic yards of structure and ditch excavation, and the placing of

27,500 cubic yards of selected borrow from pits tested by the engineers of the Soils Laboratory of the Division of Highways.

Personnel

This contract was awarded to C. W. Caletti & Co. of San Rafael, Calif., for \$226,015.00. Work was started May 10, 1936, and 275 working days were allowed for completion. The work was in charge of W. C. Colley, General Superintendent for the contractor. J. W. Cole was Resident Engineer for the Cali-

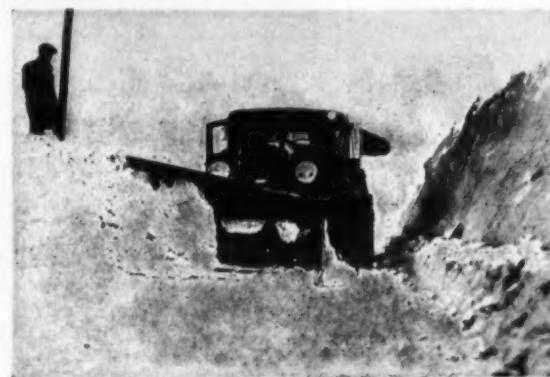
fornia Division of Highways, under R. M. Gillis, District Engineer.

Linde to Build New Plant

The Linde Air Products Co. of New York City, a unit of Union Carbide & Carbon Corp., has announced the start of work on the construction of a large manufacturing plant for the production of oxygen in South Chicago, Ill. This new plant will be the seventieth Linde oxygen plant throughout the country.

Are You Prepared for Snow Storms?

Select dependable plows now from the big line of Baker Snow Plows. There are Landside, one-way, reversible-blade and "V" type plows of time-tried and proven performance for motor trucks of 1 1/2-ton capacity up and for many leading industrial tractors.



The illustration shows Baker Model 189 Truck Snow Plow clearing a State Highway in Indiana.

**YOU ARE READY
IF YOU HAVE
BAKER
SNOW
PLOWS**

29 YEARS is a long time to be making Snow Plows for streets and highways. You get the benefit of this long experience when you purchase Baker Plows.

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Also Bulletins on Bulldozers, Road Discs, Road Rooters, Hydraulic Scrapers, Rotary Scrapers, Maintainers.

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BAKER

**SNOW PLOWS
FOR TRUCKS AND TRACTORS**

30 YEARS...

RIGHT

This Portable Roller is increased in weight to 8,600 lbs. when roll is filled with water. Suitable for patch, lawns, drives, etc.

**EXPERIENCE
BEHIND
EVERY
GALION
ROAD
ROLLER**

LEFT

"The Warrior." Weighs five to ten tons. Hydraulic steering, powered by six-cylinder engines.

Nearly a third of a century of constant improvement and study is behind every Galion unit. Self-satisfaction isn't in our book, because Galion engineers continually strive to make Galion the best on the road. Let us demonstrate.

**GALION
ROAD
MACHINERY**



ABOVE

"The Chief." Ten to fifteen tons with hydraulic steering. Can be furnished with electric starter, scarifier and sprinkler.

THE GALION IRON WORKS & MFG. CO.

LEFT

The Standard Tandem does the work of a series of tandems. Hydraulic steering and water sprinkling equipment available.

ABOVE

The Tandem Roller is an entirely new type of roller to meet a long felt need. Used for repair, widening, relocation, elevating curves and some types of new construction work.

GALION, OHIO
National Distribution

Spillway and Apron For Stewart Mt. Dam

Two Omaha Contractors Awarded Contract for Structures to Complete Unit on Salt River

STEWART Mountain Dam, about 40 miles east of Phoenix, Arizona, was completed for service in 1929, but the work at that time did not include the completion of the spillway channel, retaining walls and apron for the channel, because of insufficient funds. The dam has served its purpose during the intervening period and has been used to maximum efficiency throughout.

A contract was awarded to the Allied Bridge & Construction Co. and the Central Bridge & Construction Co., both of Omaha, Nebr., for \$152,000 for this additional construction but with the cement, reinforcing steel, new hoists for gates and other miscellaneous items furnished by the Bureau of Reclamation. WPA funds allotted to the Reclamation Service made possible the completion of the work at this time. A standard wage scale was used and 40 hour-week regulations prevailed.

Producing Aggregate for Concrete

The production of the sand and gravel for concrete aggregate as well as all excavation for the channel, piers and in the tail race was done under a subcontract by N. G. Hill & Co. of Phoenix, Ariz. This contractor used a famous piece of equipment that has seen service for many years in this district. It is an early Bucyrus-Erie dragline with four crawlers and affectionately known as "Big Bertha." It handles a 2½-yard bucket and was used first for tail-race excavation, then for stripping the sand and gravel pit, and finally the excavation of all the aggregates. The material was delivered to a hopper with a grizzly to remove everything over 3-inch size and then was fed continuously to an Iowa screening and washing plant driven by a General Electric 35-hp induction motor. No crusher was used. The material was screened into pea gravel up to ¾-inch, gravel up to 1½-inch, gravel to 3-inch and sand.

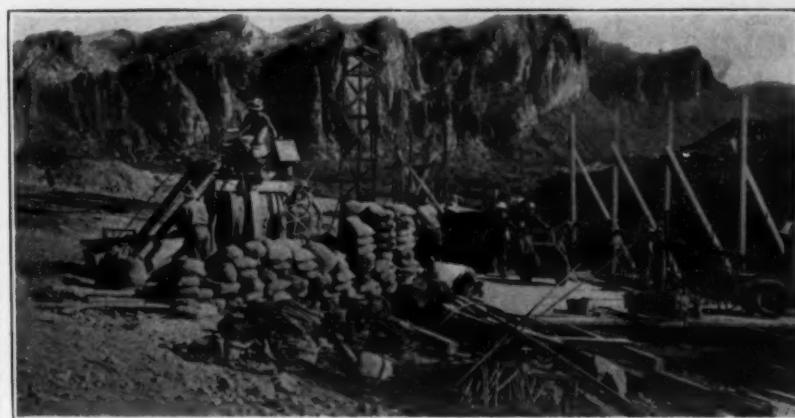
The washed and screened aggregate was delivered by belt conveyors to four hoppers, one for sand and the other three for the three sizes of coarse aggregate. From the hoppers it was hauled by trucks to stockpiles about 200 feet distant and then rehandled by a Lorain 40 truck crane to the wood bins over

the Butler weighing batchers.

The batched aggregates were hauled to the mixers by two or three 3-batch International trucks as required. Mixing equipment consisted of two Knickerbocker 2-bag mixers and a Koehring 21-E paver. The latter was used for pouring the apron slabs in squares which was done in checkerboard fashion as is usually the requirement. All concrete was mixed 1½ minutes.

Forms

The contract required the use of 180 MBM form lumber consisting of 8 x 8, 3 x 12, 6 x 6 and 1 x 8-inch shiplap lumber for the forms which were unlined. The forms were made up in panels, using 4 x 4-inch uprights and double 2 x 6-inch wales. The tie rods were plain rods with catheads and in-



C. & E. M. Photo
The Concreting Unit for the Right Retaining Wall of Stewart Mountain Dam, Part of the Bureau of Reclamation's Salt River Project

serted in paper sleeves to permit easy removal before the forms were stripped. Later the holes were plugged.

Pouring the Wall Sections

The wall sections were counterfort

section for 70 feet on the left wall and 56 feet on the right wall next the dam and then cantilever sections for 400 feet on the left and 210 feet on the right. After the forms were in place, con-

(Continued on page 40)



ON UNDERPASSES • OVERPASSES • VIADUCTS • BRIDGES • SEWAGE PLANTS
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Concrete Paving Job Well-Planned

(Continued from page 23)

plant for some unexplained reason.

The cement platform was about $\frac{1}{8}$ mile from the batcher. The trucks backed under the cement dock from which the bulk material was dumped from a pair of cement buggies for each truck. The contractor used the system of keeping two cement cars open at the same time and working four men in one car and two in the new car. After each truck had received its load of cement on the aggregate it drove forward a few hundred feet to an elevated platform where a man stepped onto the load and covered the cement with the sand of the batch. On the grade the trucks were turned on a Freeman turntable and then backed the last 200 feet to the paver.

Preparing the Joints

The utility truck hauled out the "makin's" for the expansion and the contraction joints and spotted them along the shoulder where a bench was set up and the reinforcing assembled by two men. The steel for the contraction and expansion joints was the same. It consisted of two 10-foot sections assembled separately and then laid across the 20-foot roadway. There were eight smooth $\frac{3}{4}$ -inch dowels 2 feet long tied with wire to two $\frac{5}{8}$ -inch round deformed transverse bars 9 feet 9 inches long. The joints were spaced 30 feet 4 inches apart with an expansion joint every third joint. The expansion joints were poured joints, made by inserting a metal mould in the slab when the joint was made, with a metal seal at the bottom to prevent the inflow of concrete or soil. A sheet metal clip running under the mould came up to hold the dowels in place and keep the concrete from flowing into the joint space through the dowel holes. The seal at the bottom was wired to the mould. The interlocking sections of the expansion joint molds are supported by the Minnesota method of removable end and side braces. These braces resist any displacement strains due to the strike-off and screed boards of the finishing machine and securely hold the joint molds in perpendicular position and in proper alignment. The side braces are removed after the first



C. & E. M. Photo
Unrolling Sisalkraft Paper for Curing the Slab

screeeding movement and the end supports after the second screeeding movement of the finishing machine. The expansion joints were later poured with cork and asphalt mixture.

The reinforcing for the pavement was placed by two other men. This included a $\frac{5}{8}$ -inch by 30-foot marginal bar supported at either side of the slab 6 inches from the form and 5 inches from the bottom of the slab. Temporary hooks attached to the forms held these in place until the concrete was poured. Seven center bars per 30-foot panel were placed across the center joint on 5-foot centers under the center longitudinal bars which were $\frac{5}{8}$ -inch by 30 feet long and placed 6 inches on either side of the center joint. These longitudinal bars were supported at a height of $3\frac{1}{2}$ inches by the use of long-handled chairs which were removed as soon as the concrete was poured.

The Paving Organization

The "pay mud", as one contractor referred to the concrete, on this job was handled effectively by an organization that put down an average of 1,150 feet of the 20-foot slab in the two 6-hour shifts each day. When one considers that most of the paving crews today are green and many of the men have had practically no previous experience in the handling of the type of work to which they are assigned at the start of the job, we can marvel at the amount of slab that they get laid. On this job the trucks were spotted and dumped into the skip of the Rex 27-E paver by a man who had acquired skill in the handling of truck drivers in a short space of time.

Credit is due the Superintendent for picking the diplomatic type of men for this job. We might mention here that the Superintendent was a man who relied on the proper selection of his fore-

men and then placed the responsibility for the running of their jobs on them. He had an expert mechanic who was always on call and when a breakdown occurred or some part needed adjustment the mechanic rushed out to the scene of the trouble and assumed command until the repair or adjustment was made. The Superintendent always showed up but was the executive not the laborer on the job. This is the way a job should be organized, with a calm head able to organize and direct, and not with the wild cursing man who has to do everything himself, in command.

The paver, which was set for a 60-second mix, pulled a Koehring grade planer from which two men shoveled the excess dirt. There were three pavers and one man who spaded the concrete against the forms on one side and the operator of the Ord finishing machine spaded the other side. The double screed finisher trailed a 4-wheel bridge on its second pass over the new concrete from which one man installed the metal mould for the poured center

dummy joint. This mould consisted of a top plate with two angles holding a vertical plate making a "T" $2\frac{1}{2}$ inches deep and 2 inches wide.

Two men with a 12-foot bull-float also worked the machine for cutting the contraction joints. Then came two men with aluminum straight-edges used as drags to remove excess water and laitance followed by the use of a 10-inch canvas belt by the same two men. They also edged the slab where lip curb was not to be installed.

The master finisher checked the slab with a 10-foot aluminum straight-edge and then pulled the center joint moulds with a hook working from a 4-wheel bridge. The two men who spread the Sisalkraft paper for curing helped with the bridge for the master finisher. The paper was used in 75-foot rolls carried on 2 x 4's and was 22 feet wide. The paper men had a bridge for their use so that they could cross the green concrete whenever necessary. The paper was left on the slab for 72 hours and at

(Continued on page 44)

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Ada County, Idaho, Kept Open Some 800 Miles of Roads Last Winter with Three LeTourneau RD6 and Two RD7 Angledozer on Caterpillar Tractors. One of These Units, an RD6, is Shown Above

Summer Activities Of Dallas County, Tex.

Dallas County, Texas, will place single asphalt surfacing on about 75 miles of its roads this summer, in addition to which considerable improvement and new construction has already been contracted, including the improvement of the Centerville road, to cost \$17,300; improvement and drainage structures on the Belt Line Road, an item of \$10,790; and the improvement of 1,250 feet of the Eighth Street Road Extension, to cost \$7,685.40, for all of which work the Vilbig Construction Co. is the contractor.

The Uvalde Construction Co. has been awarded a contract amounting to \$7,210 for road surfacing on the Belt Line Road; Williams & Whittle have received a contract for improving Joe Field Road, 18-foot concrete pavement, to cost \$14,300; a new bridge costing \$16,200 will be constructed over the West Fork of Trinity River on the Belt Line Road by the Austin Bridge Co.; Jno. F. Buckner has a contract amounting to \$2,000 for repairs on a bridge over the Elm Fork of Trinity River on the Joe Field Road; and the Texas Bitulithic Co. has two contracts, one of \$12,200 for improving Irving Road and one of \$10,000 for the construction of an overpass over the Southern Pacific Railroad on Abrams Drive. In addition, Williams & Whittle has a contract for concrete paving on Industrial Boulevard, amounting to \$14,000 and there is considerable improvement work on Mountain Creek Lake Road, including a \$35,000 contract for bridges awarded to R. L. Wallace, and grading and small drainage structures, amounting to \$30,000, awarded to Vilbig Construction Co.

R. H. Clinger, County Engineer of Dallas County, reports that the county recently purchased fourteen 1½-ton and one 3-ton trucks, one tractor, five dump trailers, one asphalt distributor, one maintainer, one wagon scraper, four

power mowing machines with small tractors and four service automobiles.

New England Dealer Opens New Warehouse in Maine

Hedge & Mattheis Co., equipment distributor in Boston and other New England cities, recently opened a new warehouse at 153 Center St., Bangor, Maine. This branch, the tenth in the chain of Hedge & Mattheis' warehouses, will carry a complete line of construction equipment for contractors and municipalities, for sale or rent. R. W. Naugler, who has been closely associated with the construction industry, will be in charge.

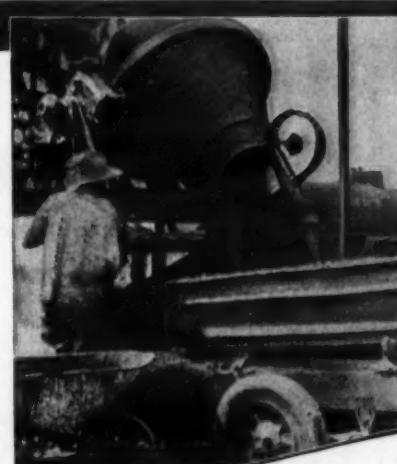
This company has also announced the removal of its Hartford warehouse to larger quarters at 391 Prospect St., East Hartford, Conn. W. S. Childs, who has been prominent in the sales organization of the main office in Boston for the past nine years and was previously associated with the Turner Construction Co., will be in charge.

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Road Engineer Discusses Causes of Scaling

(Continued from page 4)

for workability. As an example, a mix designed using the mortar voids method results in a one-sack batch, dry weights, of 193 pounds of sand and 338 pounds of stone. Using the same materials but redesigning the mix for a minimum amount of mortar, a one-sack batch containing as little as 160 pounds of sand with as much as 372 pounds stone and having the same cement content may be obtained.

The latter mix is workable although it contains a theoretical reduction of approximately 9 per cent of mortar. It is interesting to notice the difference between these two mixtures in their action under the screed. In the first a relatively large amount of mortar floats to the top, where it accumulates in front of the screed and is passed back and forth over the main body of the mix, forming a thick surface film of weakened concrete. In the second, the mix remains more unified, inasmuch as there is only enough accumulation of mortar in front of the screed to form a very thin film over the surface.

The slump has a decided effect on the finished surface. As the slump is increased, the screed will bring more fine materials to the surface. Likewise the prolonged action of the screed and finishing belt will produce a film of weaker mortar on the surface of the concrete pavement.

Without strict supervision, the workmen on a concrete paving project are often inclined to use a concrete of greater slump, and use the finisher longer than is necessary or desirable for a good surface.

It is a logical conclusion that an extremely wet mix or over-finishing of the surface brings to the top of the surface

a thickness of undesirable mortar which is bound to scale off under the action of traffic. This may be corrected by a careful control of the proportioning of the materials as well as the slump, together with finishing only sufficient to insure a smooth-riding surface.

Cement As Possible Cause

It is possible that still another potential cause of scaling may be found in the cement itself. Many questions can be raised concerning the modern portland cement. Do concrete pavements constructed with one type of cement scale more than those constructed with other types? Has the quest for higher strengths and especially high-early-strengths affected some of the other properties of modern cements?

An investigation of the records will disclose progressive changes from the cement of three or four decades ago. The fineness, the amount passing the 200-sieve, has increased from 80 per cent to 97 per cent in the past forty-seven years. The finer the cement the more rapid and complete the hydration, but there is a question as to whether or not greater heat is generated in the chemical reaction producing an undesirable condition.

The tricalcium silicate has been increased to produce higher strengths. This is substantiated by the average figures for fifty tests of one brand of cement used in Michigan from 1920 to 1936. This cement in 1920 showed a tensile strength of 230 pounds at 7 days and 330 pounds at 28 days, in 1925 its tensile strength had been increased to 300 and 400 pounds, respectively, and in 1936 to 360 pounds at 7 days and 500 pounds at 28 days. The A.S.T.M. requirements for 1930-37 are 225 pounds at 7 days and 350 pounds at 28 days.

Whether or not the changes in cement in obtaining these higher strengths have contributed to the causes of scaling is at present only a matter of conjecture, but should be the basis of future investigation.

As to the ability of different cements to resist certain alkalis, the results of the study of the Bureau of Public Roads at Medicine Lake, South Dakota, published in the May, 1931, issue of *Public Roads* bring out the following conclusions on this subject:

"Giving due weight to those cylinders that have disintegrated and considering such compression tests as have been made, conclusions relative to this group (5,400 cylinders in 120 series using standard portland cements from 34 different mills) may be stated as follows:

(1) Enough difference exists in the resistance of cylinders of standard portland cements from different mills to justify specifying particular cements for

concrete that must withstand such conditions and also to warrant further investigation regarding the constitution and manufacture of the cements found best qualified to withstand alkali action. The marked differences in resistance of these cements are evidenced by appearances of the cylinders at all ages, by such 3 and 5-year compression tests as have been made, and by actual comparative strength ratios at one year.

(2) The resistance of different lots of cement from any plant is fairly constant.

Conclusions

Not much progress can be hoped for until the highway profession is sufficiently aroused to put forth a concerted effort to exhaust every avenue of approach in a scientific manner. So far, most of the work has been done by interested parties in an attempt to vindicate their own contributions to the concrete highway. While this sort of experimentation is enlightening, no conclusions may be reached until all the data thus set forth are received in the light of

scientific detachment. There should be a complete correlation of all data now available to form the basis for an exhaustive study of all the possibilities involved in this problem.

Yours very truly,
J. K. NORTON, Road Engineer,
Board of County Road Commissioners
of Wayne County.

Detroit, Mich.
June 26, 1937.

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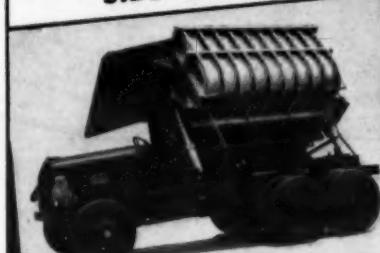
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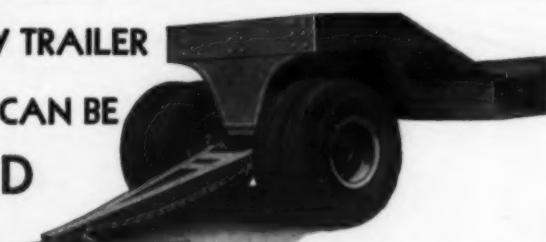


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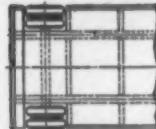
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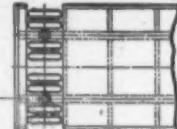


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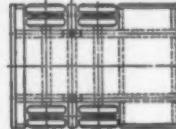
C. R. JAHN COMPANY,



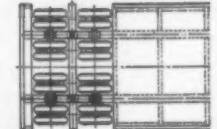
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COME TO TRAILER HEADQUARTERS

Procedure of Stabilizing Clay Soils with Asphalt

(Continued from page 11)

The Road-Mix Method

For the road-mix method, the surface should be scarified as previously described, until uniformly broken up and free from large lumps. So long as a small lump is completely coated it appears to cause no harm. The asphaltic material should be applied in successive applications of approximately 0.5-gallon per square yard by means of a pressure distributor, followed by harrowing after each application, preferably with disc harrows. For depths over 3 inches this amount should be bladed to either side of the road in two windrows after three applications of bituminous material have been made, and the lower layer treated in similar fashion. The windrows then should be bladed back over the surface in thin layers until the surface is smooth and even. Continued diffusion of the bituminous material throughout the soil mass will continue, especially if sufficient moisture is present, from 8 to 20 per cent, until a uniform condition is obtained. The motor patrol blade grader is good equipment for use during this setting up period, although tractor-drawn separate graders may be used. The kneading action of rubber tires, such as on most patrol graders, is very helpful in obtaining the best results. The use of the multiple rubber-tired roller is also advantageous.

The traveling plant has been used successfully in this class of work. The road surface should be scarified to the required depth and the loose material bladed to a windrow in the center of the road. This windrow is then picked up in the usual fashion and run through the mixer. In order to have a dischargeable mix, it is usually necessary to add from 25 to 35 gallons of water per cubic yard of soil, the water being added prior to the bituminous material.

Asphalt Membrane Method

This method may be employed either at the time of completing a graded earth road or afterward when complete settlement has occurred. The lower membrane should be at a depth of 8 to 20 inches below the surface, depending upon conditions.

For new grading, the surface should be consolidated and smoothed parallel to final surface, but at the elevation determined upon for the lower membrane. The asphalt cement should be applied hot, at approximately 300 degrees F., and a fairly low penetration should be used, 60-70, 85-100, or 100-120. The rate of application should be approximately 0.5 gallon per square yard. There would appear to be possibilities in the use of cotton fabric or burlap as a reinforcing agent under certain conditions.

The final layer of soil should then be dumped and spread to the finished grade. Care should be taken not to move over the uncovered membrane and the usual procedure is to stockpile selected soil for this final layer during rough grading, and then to end-dump

over the membrane with trucks or bulldozers, spreading and finishing with blade graders. This top layer of soil should not extend beyond the membrane on either side, but when spread and compacted there should be an uncovered strip approximately 6 inches wide on either side.

After thorough compaction has been obtained over the surface, the edges should be hand tamped, and the second application of asphalt made over top and sides so as to join the lower membrane previously left uncovered. This treatment should consist first of a primer, the medium-curing cut-backs MC-1 or MC-2 being best for this purpose, followed by an application of hot asphalt at the rate of 0.5 gallon per square yard. This seal should be covered with 40 to 50 pounds of $\frac{3}{4}$ -inch crushed aggregate and then lightly rolled. The use of cotton fabric in this upper membrane appears to have possibilities.

For roads already graded, the surface

should be scarified to the desired depth and the earth removed to a windrow on either side. The lower asphalt membrane should be applied one-half width at a time, and the earth then brought over from one windrow to within 6 inches of the center edge. The other half of the lower membrane should then be applied, lapping over the first half, and the second windrow spread. The remaining operations for compaction should be the same as previously described, and the upper membrane application is done in the same manner.

While this membrane method is new, it appears to have very real possibilities for constructing substantial subgrades that will be unaffected by changing seasons. A total application of asphaltic material not exceeding 1.5 gallons per square yard may be made to render waterproof a considerable depth of soil, so that with a thin wearing course which will take abrasion there will be afforded all the support required for many miles of highway.

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Concrete Structures to Complete Dam in Ariz.

(Continued from page 35)

creting was handled by moving one of the 2-bag mixers as close to the section as possible but where the trucks with the batches could reach the skip safely. A runway was built down to the lower sections of the walls and when pouring the top sections, which were handled in 10-foot lifts, a material elevator was constructed and operated by a Thomas Elevator Co. single-drum hoist driven by a Continental engine.

From three to eight Ayrgo concrete buggies with pipe handles and Goodrich 5.00 x 15 pneumatic tires were used. There was one man on each buggy coming up the runway and a second going down to brake its speed. The buggies were dumped through openings in the runways with one man shoveling the dry concrete that stuck to the buggy, and two men in the forms finishing. There were no puddlers as that was taken care of satisfactorily by two Mall vibrators driven by gas engines and with extension tubes to permit easy reaching of any part of the forms. Heavy reinforcing made the use of the vibrators necessary to insure close contact between the concrete and the steel. The footing of the walls was poured first and then the wall in 10-foot lifts. The walls were a maximum of 43 feet in height.

All curing of concrete was done by $\frac{1}{2}$ -inch spray pipes laid over the tops of walls or on the apron rectangles. The surfaces were covered with burlap and then sprayed for 14 days.

Spillway Section

The work on the spillway involved chipping a large section of the old ogee spillway section to provide a bond for the new spillway. This was done with Ingersoll-Rand breaking hammers. The old spillway and new apron combine to form a curved and banked channel, which is to maintain a uniform depth of water through any radial section and the entire apron is sloped downward toward the right wall. Close to the dam the apron is raised above the ground surface to reduce excavation quantities in the new channel. The supporting walls are carried deep into bed rock and the apron itself is at heights varying from 15 to 34 feet above the ground elevation, in the area adjacent to the dam.

Excavation for the new spillway channel was done by a 1-cubic yard Link-Belt shovel, loading to a fleet of six 3-cubic yard International trucks.

Cut-Off Wall

At the downstream end of the apron a new cut-off wall was built to prevent undercutting of the apron by the water in flood stages. The excavation of the cut-off trench into rock was done entirely by hand labor with the use of two I-R compressors, one 125 and the other a 110-foot unit, and jackhammers. This was carried into bed rock at depths of 3 to 20 feet.

For repairs and other cutting and welding services the contractor used a set of Balbach welding tips and regulators for the gases.

For late work after sundown the contractor provided six floodlights with 500 to 750-watt incandescent lights in pairs.

Labor Organization

Work on this contract was started February 23, 1936, with an allowance of 180 calendar days for completion. The labor was divided into two 8-hour shifts for both concrete and carpenter outfits. A total of 120 men was employed almost continuously from the start of the work to insure the completion of the work within the contract period.

Quantities

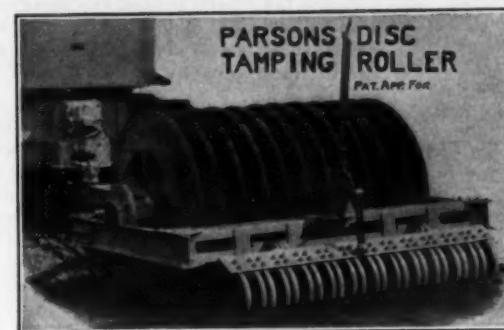
The major quantities for this project which was constructed for the bid price of \$150,723.50 were:

Item	Quantity	Unit Price
Excavation, class 1, earth...	27,500 cubic yards	0.35
Excavation, class 2, decomposed rock...	32,500 cubic yards	0.85
Excavation, class 3, solid rock...	1,500 cubic yards	1.00
Excavation, river channel...	5,000 cubic yards	0.46
Excavation of old concrete...	40 cubic yards	5.00
Chipping and roughing old concrete...	360 square yards	0.65
Backfill about structures...	7,000 cubic yards	0.46
Concrete, spillway walls, bucket, piers and supported floor...	3,700 cubic yards	10.00
Concrete, spillway paving, slab and cut-off wall...	4,000 cubic yards	6.00
Concrete in motor generator house...	22 cubic yards	20.00
Placing reinforcing bars...	750,000 pounds	0.017

Personnel

Edgar Y. Grupe, Vice President of Allied Bridge & Construction Co. of Omaha, Neb., was in charge of the contract with M. E. McKeon as Superintendent. For the Bureau of Reclamation the work was under the Phoenix District office, with E. C. Koppen as Project Engineer in charge and Joseph A. Fraps as Resident Engineer.

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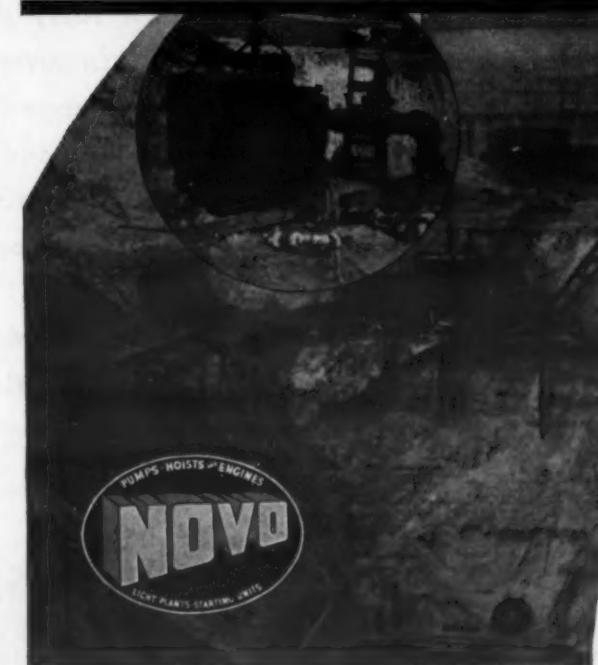
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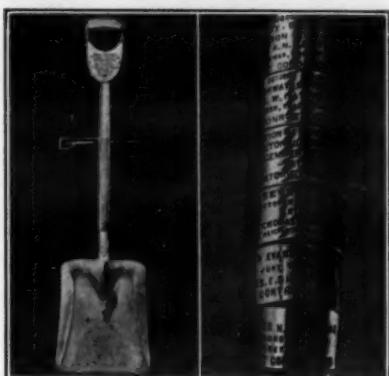
Couse and Sanders, contractor of Detroit, put in the disposal plant at Ludington, Michigan. Excavation was 22' below Lake Michigan's level—lake only 200' away. Digging in the free flowing, water bearing sand with a large brick building only 20' away. These were the conditions encountered where the Novo standard 6" Self Priming Centrifugal Pump was installed to de-water the 80 well points around the excavation.

Not only was there a possibility of the hole filling up, in which the contractor had \$15,000 invested, but also of the adjacent building sliding into the hole.

This is another demonstration of the ability of the standard Novo pump to handle well pointing under the most trying conditions.

Write for full information on Novo Pumps.

NOVO ENGINE CO.
216 PORTER STREET
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Left, the Silver Shovel Which Has Helped Dedicate Eighteen Concrete Highways and, Right, the Silver Bands on the Handle

Silver Shovel Plays Part In Many Concrete Roads

This is the story of an historic silver shovel, which has been wielded by governors, lieutenant governors, state and county highway officials and by Alice Roosevelt Longworth in the dedications of eighteen outstanding concrete highways in Pennsylvania, Michigan, Indiana, Illinois and Iowa. As shown in the illustration, there are attached to the handle eighteen silver bands, suitably inscribed, giving the facts about each dedication.

The concrete paving field is the largest single market for cement, taking normally more than one-third of all the cement produced, in addition to large quantities of steel for reinforcing, tools and road-building equipment.

The material for this story and the photographs were furnished by the Universal Atlas Cement Co., a subsidiary of the United States Steel Co., of Chicago, Illinois.

Crane and Shovel Bulletin

A new bulletin describing and illustrating Manitowoc Speedcranes, shovels and draglines has recently been issued by the Manitowoc Engineering Works, Manitowoc, Wis. This bulletin contains a large number of interesting job photographs, showing Manitowoc equipment in use on a variety of construction proj-

ects, as well as depicting the various mechanical features of these units. Complete specifications of the machines are also included.

Copies of this new bulletin may be secured by interested contractors and engineers direct from the manufacturer by mentioning this magazine.

Hercules Engines Displayed At Road and Marine Shows

At various exhibits of road-building equipment held during recent months in various parts of the country, and at the New York motor boat show, a large number of Hercules engines were on display. At the New Orleans Road Show, 50 per cent of the equipment powered by multi-cylinder engines was

equipped with Hercules engines, according to a recent report from the Hercules Motors Corp., Canton, Ohio. At the Southwest Road Show in Wichita, Kansas, twenty-three different manufacturers of equipment requiring internal combustion engine power had displays, of which more than 50 per cent showed Hercules engines.

An expenditure of 6,000,000 pesos for work on the section of the Inter-American Highway between Mexico City and the Guatemalan border has been authorized by the Mexican Government. Of this, about 1,000,000 pesos will be spent on the construction of a bridge over the Suchiate River and on a stretch of road from there to Tapachula, according to a report from the U. S. Bureau of Foreign and Domestic Commerce.

FOR DEPENDABLE SERVICE CHOOSE HUBER!



STAMINA . . . sturdy construction . . . plenty of reserve power . . . simple, easy operation . . . modern design and practical engineering features have made Huber the outstanding Road Roller for years. For low cost performance and dependable service, investigate Huber. Write for new descriptive literature.

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FROM 5 TO 10 TONS . . . GASOLINE OR DIESEL POWER

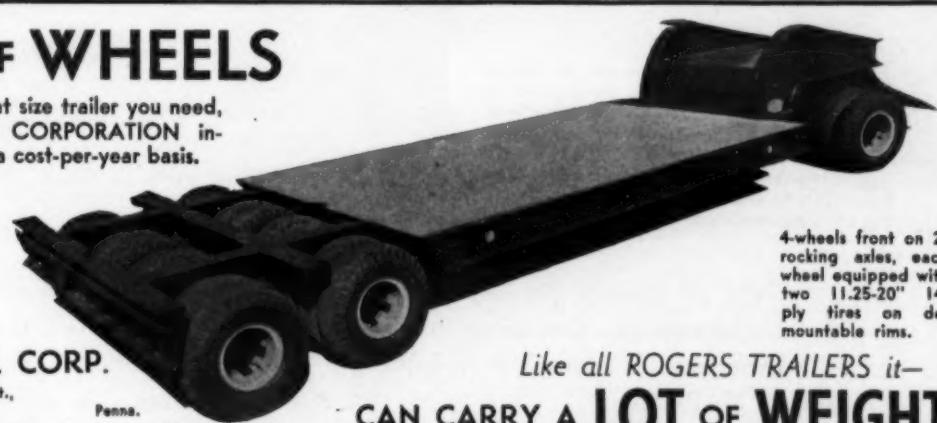
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Yes, but no matter what size trailer you need, ROGERS BROTHERS CORPORATION invites comparison on a cost-per-year basis.

A 75-ton trailer.
8-wheels rear on 4-rocking axles, each wheel equipped with two 9.75-15" 14-ply tires on demountable rims.

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Manufacturers of Low Bed Heavy Duty Trailers Exclusively



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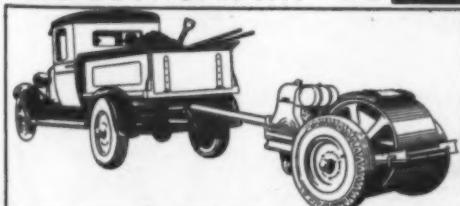
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FOR SPEED
and ECONOMY . . .

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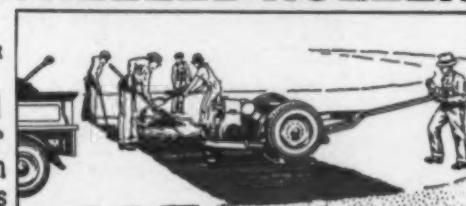
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COMPRESSION 135 LBS. PER
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The most economical
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for all types of patch
work and miscellaneous
small jobs



To and from the Job
a High-speed Trailer

Write for DETAILS!



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a Self Propelled Roller

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**Guaranteed
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CORPORATION**

— and because smoother surfaces and tighter joints minimize costly rubbing and finishing once the pour is made.

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for a live contractor.

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Bulletins and Pamphlets

(Continued from preceding page)

New Volume Pump for Lubricants

279 Complete information on the new Alemite volume pump for lubricating track rolls, as well as the other types of Alemite guns and lubricating equipment, is contained in the new manual "Alemite Controlled Lubrication," copies of which may be secured gratis direct from the Alemite Division, Stewart-Warner Corp., Dept. F, 1850 Diversey Parkway, Chicago, Ill.

Plywood for Concrete Forms

280 "Facts about Douglas Fir Plywood" is the title of a new book issued by the Douglas Fir Plywood Association, Tacoma Bldg., Tacoma, Wash., containing informative data about the many uses of this material in building, both as structural material and for forms. Copies may be secured free by mentioning this magazine.

Hydraulic Laboratory Presses

281 Bulletin B-19, describing Watson-Stillman hydraulic laboratory presses for testing the compressive strength of concrete cylinders and brick in state and county highway laboratories, may be secured by interested engineers direct from the Watson-Stillman Co., 108-140 Aldene Road, Roselle, N. J.

Booklet on Simple Arch Bridges

282 "Armeo Multi Plate Bridges" is the title of an attractively colored 16 page booklet recently published by the Armeo Culvert Manufacturers Assn., Middlebury, Ohio. The booklet shows single, twin and triple arch bridges and a large pipe structure, stressing both the beauty and utility of such structures. Copies of the booklet may be obtained free from Armeo.

Snow Plows for Motor Trucks

283 Bulletin No. 754A, describing Baker V-type, reversible trip blade, reversible rigid blade, one-way trip blade and Landside snow plows for mounting on light, medium and heavy-duty trucks, to meet the varying snow conditions on state and county highways, may be secured by those interested direct from the Baker Mfg. Co., 585 Stanford Ave., Springfield, Ill.

An Auto Patrol Booklet

284 Caterpillar Auto Patrols, the work they will do and their mechanical features are the subject matter of a new booklet, Form 4052, issued by Caterpillar Tractor Co., Peoria, Ill. Action pictures, model views and photographic details of the features of the machine are used to point out the advantages and the adaptability of these power-operated patrol graders.

Wire Rope for Construction Jobs

285 Williamsport Purple-Strand Form-Set wire rope, designed to provide safe and dependable service on construction equipment, is described in a manual which the Williamsport Wire Rope Co., 122 So. Michigan Ave., Chicago, Ill., will be glad to send on request. When writing, mention the type of equipment you have.

Trucks for Road Building Service

286 Complete information on Ford V-8 trucks for use by contractors on road building and other construction jobs and by state and county highway departments in their construction and maintenance work may be secured from the Ford Motor Co., Dearborn, Mich.

Sand and Gravel Washers

287 Bulletin W2 describing Eagle screw and paddle type sand and gravel washers in sizes to suit the varying requirements of construction jobs may be secured by interested contractors from the Eagle Iron Works, Des Moines, Iowa.

Manual of Concrete Curing

288 The 1937 revised manual of concrete curing, a 52-page booklet covering the new A.S.T.M. specifications for calcium chloride and a thorough discussion of many new problems, may be secured upon request direct from the Columbia Alkali Corp., Barberton, Ohio.

Lubricants for Construction Equipment

289 Complete information on Texaco lubricants for construction equipment, as well as recommendations on the selection and application of lubricants to meet any special lubricating problems by trained lubrication engineers, may be secured without obligation from the Texas Co., 135 E. 42nd St., New York City.

Asphalt Kettles for Maintenance Jobs

290 Littleford Bros., 485 E. Pearl St., Cincinnati, Ohio, will be glad to send to interested state and county highway officials complete information on Littleford asphalt heaters and kettles for all kinds of maintenance jobs.

Rotary Snow Plows for Tractors and Trucks

291 Complete information on Snow King rotary snow plows for mounting on Caterpillar tractors or for four-wheel-drive trucks may be secured by state and county highway engineers direct from the Rotary Snow Plow Co., 611 Central Ave., Minneapolis, Minn.

Hoists and Dump Bodies

292 Hercules Steel Products Co., Galion, Ohio, will be glad to send to those interested complete information on its super-power center-lift hoists for truck bodies of every capacity and also its steel bodies of new design and improved construction.



METERED Vacuum CONTROL
big yardage
LITTLE EFFORT

Here's a machine that piles up big yardage without calling for marathon endurance from the operator.

METERED VACUUM CONTROL speeds up digging by making every swing of the dipper fast and accurate. Finger tip pressure by the operator commands instant response from the machine.

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Write for
Bulletin "C"

You'll point with pride to your new MICHIGAN—its appearance now matches its great performance!

MICHIGAN POWER SHOVEL CO.
BENTON HARBOR, MICHIGAN

Concrete Paving Job In Wis. Well-Planned

(Continued from page 36)

the end of 24 hours the forms were pulled and the paper pressed against the edge of the slab and held with earth. Three teams with flat bed wagons hauled the forms, pipe line and paper forward as soon as released from the rear. A foreman with six laborers pulled the forms early in the morning and then quit for the day. This same crew also rolled up the paper at the end of the curing period, repaired it with asphalt and had it ready for the teams to haul forward. In placing the paper it was lapped 2 feet and weighted down with dirt.

At the start of the work and before the forms had been placed, drums of the asphalt for pouring the center joint were spotted along the shoulder by the utility truck. When the curing had been completed, the joint spaces were poured by a crew of four men with hand pouring pots. The asphalt was melted in a heating kettle, using a kerosene burner. The asphalt carried an admixture of diatomaceous earth in the amount of 20 per cent by weight of the mixed filler.

Lip Curb

Lip curb is run on all sections where there is a grade and on the inside of super-elevated curves. On this particular contract there was continuous lip curb because the slab was almost uniformly sloped away from the railroad

for the entire distance, giving uniform drainage and thus leading the water to drain basins and drop inlets of which there are 180. The concrete for the curb was hauled back by two wheelbarrows, the wheelers shoveling to the forms which had been set by one man ahead. One man built up the concrete into the form and a finisher followed. The curb was 4 inches high and 12 inches wide with the surface exposed to traffic being rounded to an arc having a radius of 4 feet. A 1 x 4-inch board held at the right distance from the forms by two strap irons aided the curb builder to keep the line true and distribute the correct amount of concrete to finish the curved surface.

Water Supply

Plenty of water was available for the mixer as the contractor set up a Jaeger triplex and a Domestic triplex on the shore of the Father of Waters and pumped with one or the other to a 2½-inch line laid along the east shoulder of the road and protected at all crossings by burying. The paver valves were put into the line at 240-foot intervals and the paver carried 150 feet of hose.

Trimming Slopes

A crew of fourteen men and a foreman did all the trimming of the slopes with a rounded top on a 5-foot radius, by hand. This operation was continuous throughout the length of the contract and the work was well done and a credit to the diligence of the foreman.

Personnel

This 10-mile contract for Project

61-3-24-1 & 2 between Lake City and Wabasha, Minn., for paving, regrading and shoulder was awarded to W. W. Magee of St. Paul, Minn., for \$245,-

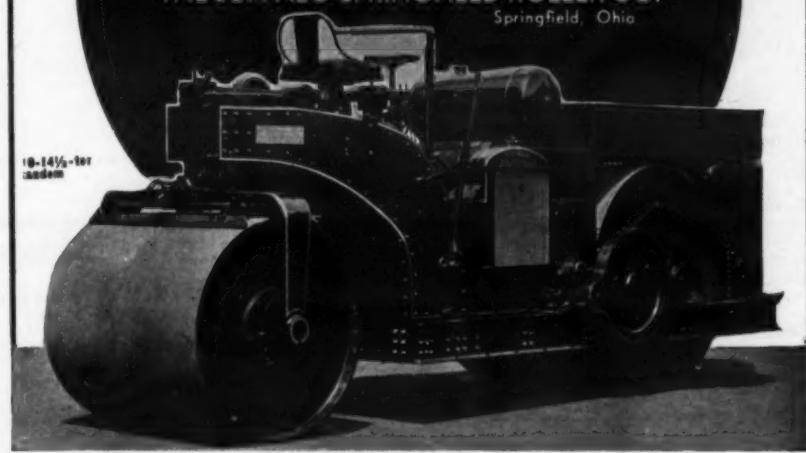
816.06. E. P. McGahn was Superintendent for the contractor and M. H. Johnson was Resident Engineer for the Minnesota Highway Department.

Faithful performance

Faithful performance and economical maintenance have been the pillars of Buffalo-Springfield's reputation for forty-six years.

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When you're exhausted from the strain of a long trip, and you crave a place to stretch out and relax - there's nothing more wonderful than to walk into an Albert Pick hotel, where you are made to feel AT HOME, and enjoy the luxury of personal service, restful slumber and delicious food in air-conditioned dining rooms. At prices that are easy on your pocketbook.



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CINCINNATI, OHIO FOUNTAIN SQUARE
CANTON, OHIO BELDEN
ST. LOUIS, MO MARK TWAIN

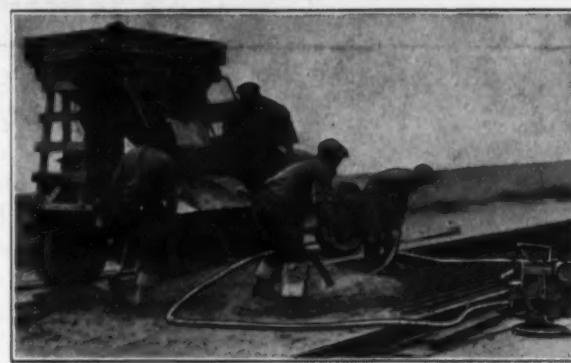
INDIANAPOLIS, INDIANA ANTLERS
SOUTH BEND, INDIANA OLIVER
ANDERSON, INDIANA ANDERSON
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Type and
Size of

Mall
TRADE MARK
Vibrator
for
EVERY
Job!



Placing concrete on deck slabs with a Mall gas engine vibrator unit. Low round base and pneumatic wheel, wheelbarrow mountings are available.

A MALL vibrator on your job will pay for itself many times over with lower labor and material costs and improved quality concrete.

Gas engine, air, and electric sets are available.

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INDEPENDENT PNEU. WESTERN WHEEL SCRAPER CO.—Wheeler
MATIC TOOL CO.—"There" Air and Electric Tools
WILLIAMS—Clamshell and Dragline Buckets
AMERICAN STEEL & WIRE CO.—"Moline" Wire Ropes
DOMESTIC—Pumps and Hoists
M & M Form Clamps
WYOMING—Red Edges
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BROWNING—Truck Cranes, Shovels, Locomotive Cranes
OWEN—Clamshell Buckets
OMAHA—Dragline Buckets
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McKERNAN-TERRY CORP.—Pile Hammers
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NOVO—Engines, Pumps, etc.
UNIVERSAL—Panel Forms, Form Clamps, etc.
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Glasgow, Mont.
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"LA PLANT-CHOATE"—Bulldozers, Snow Plows, Dump Wagons.
"LETOURNEAU"—Dirt Moving Equipment.
"KILLEFORD"—Road Rollers, Scrapers.
"ATHY"—Trailers, Dumb Wagons.
"BUCKN-ERIE"—Power Cranes, Drawings.
"PIONEER"—Cranes, Drawings.
"REX"—Mixers, Pavers, Moto-Mixers, Pumps, Saw Bins.
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MUNGEON—Air-Operated Concrete Vibrators
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PENNSYLVANIA—Air Compressors and Pumps
DAVID ROUND & SON—Chain Hoists
STAYBURN—Air and Pipeline Tools
THE STRAND CO.—Flexible Shaft Equipment
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VICTOR—Welding and Cutting Apparatus
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Complete Line of Road Machinery and Contractors' Equipment
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INSLEY Concr. Towers PARSONS Ditchers
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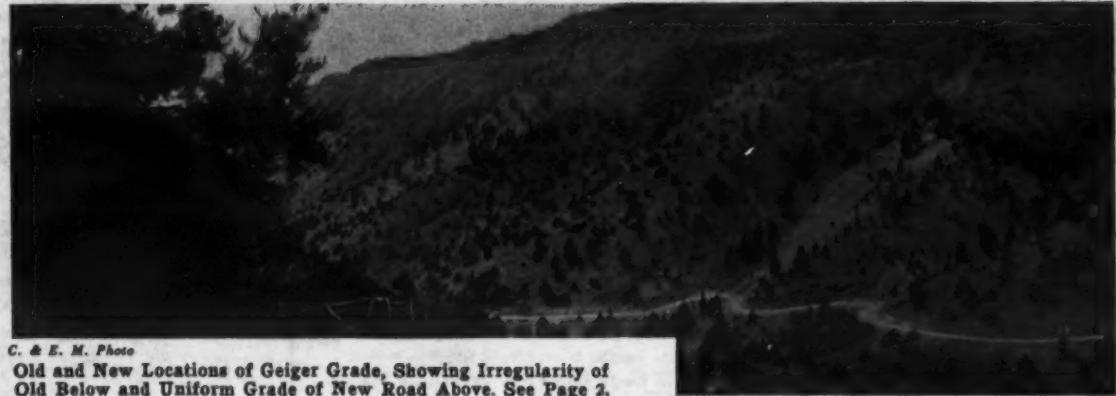
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C. & E. M. Photo
Old and New Locations of Geiger Grade, Showing Irregularity of Old Below and Uniform Grade of New Road Above. See Page 2.



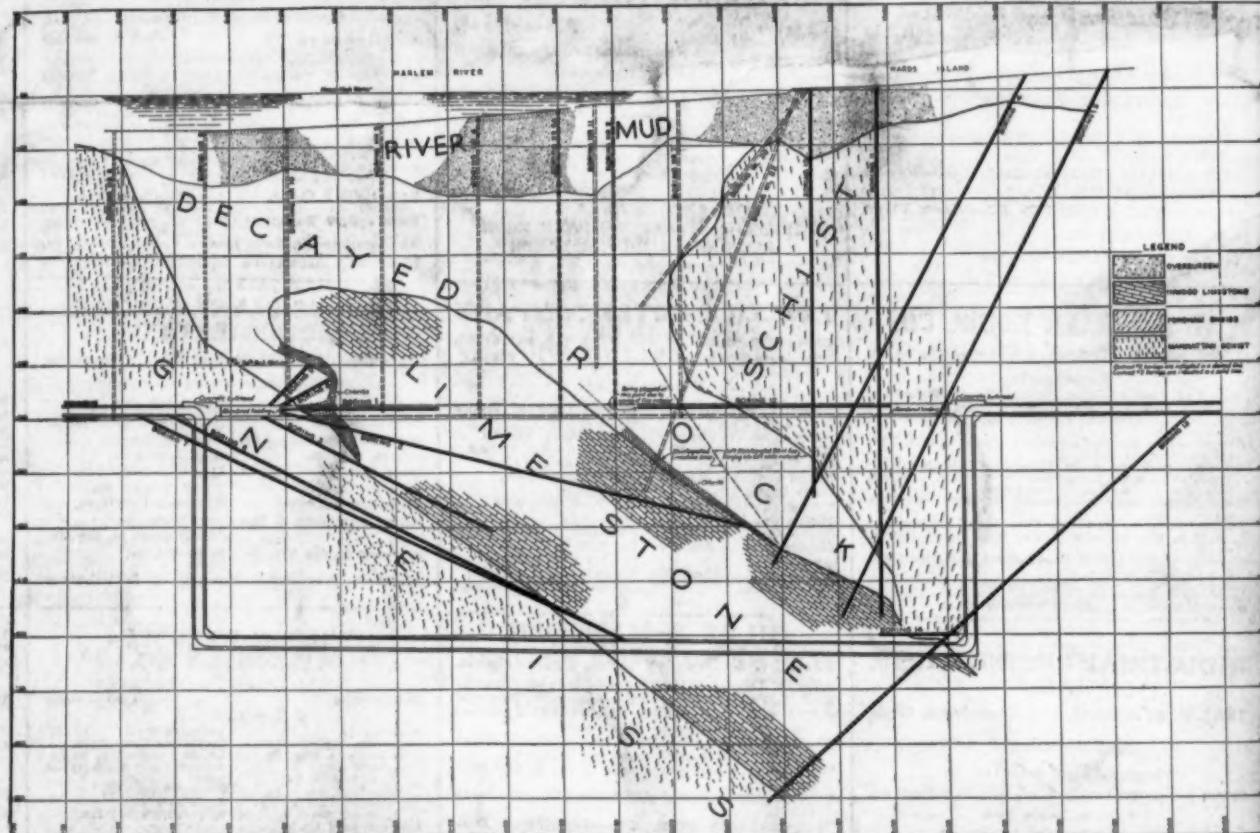
C. & E. M. Photos
The Front, Middle and Rear of the Drag Used for Spreading Rock Asphalt Resurfacing. See Page 1.



More Conventional Duties for a Rotary, Clearing a State Highway in Montana. See Page 2.



C. & E. M. Photo
W. C. Colley, General Superintendent for C. W. Caletti & Co. on Its 8-Mile Grading Contract in Madera County, Calif., and (Right) R. S. Badger, District Construction Engineer, Fresno District, Calif. Div. of Highways. See Page 27.



Right, Diagram of Borings Made Preliminary to and During Construction of the 110th Street, Manhattan-Wards Island Sewer Tunnel, for which Geo. H. Flinn Corp. Is the Contractor, to Determine the Subaqueous Rock Structure.

Below, the Headframe at the 110th Street Shaft, Showing the Compressor House at Left. See Page 1.



C. & E. M. Photo
The Brick Laying Crew on the Blackwell Corp. Contract in East St. Louis. See Page 20.